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The Stiles & Parker Press Company's Presses.

We present on this page, engravings and some details of two of the presses for sheet metal work, made by the Stiles & Parker Press Company, Middletown, Conn. These machines are made in a variety of sizes, and for a great variety of work, from the finest work of the jeweler and watchmaker up to heavy ordinary work.

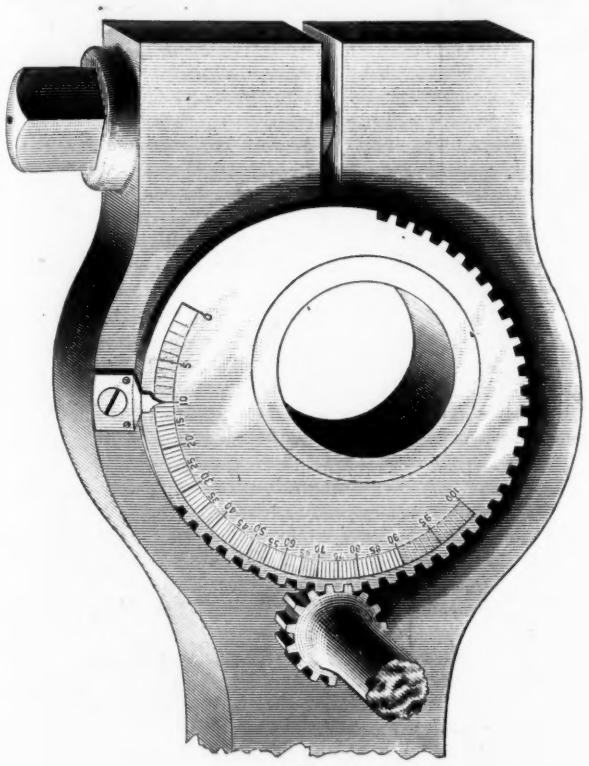


FIG. 1.

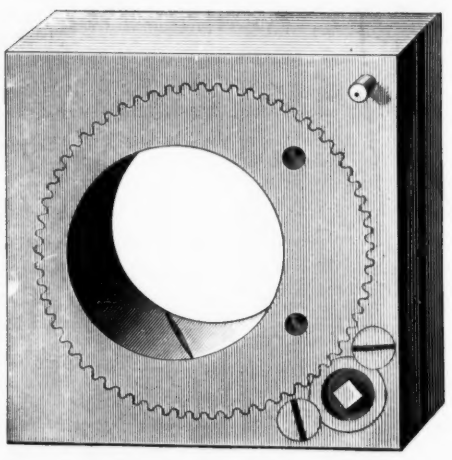


FIG. 3.

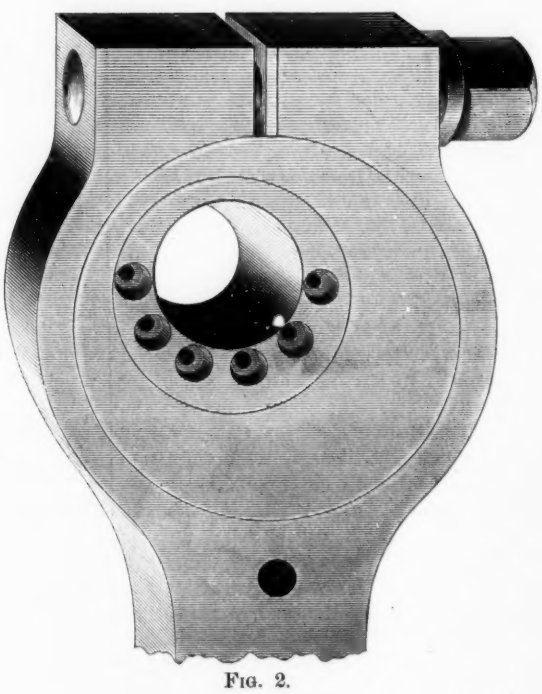
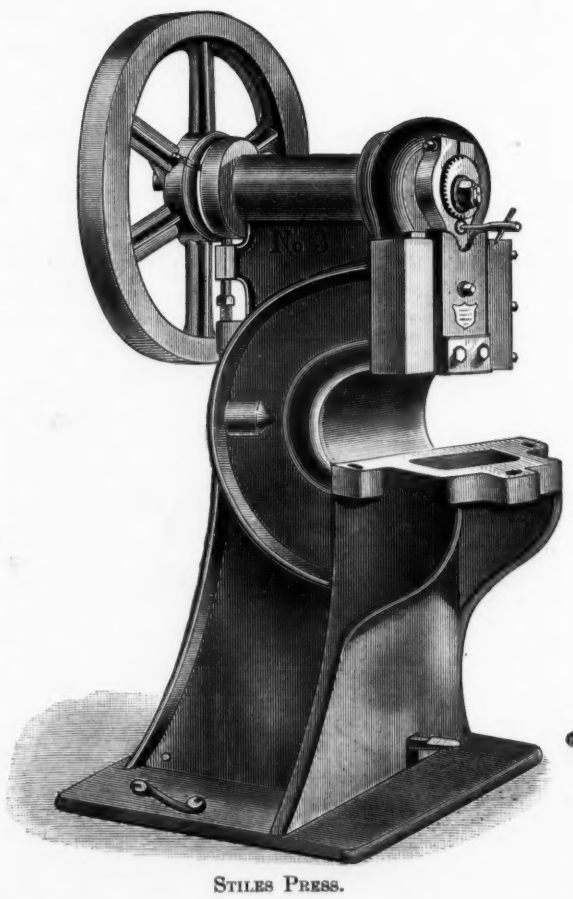
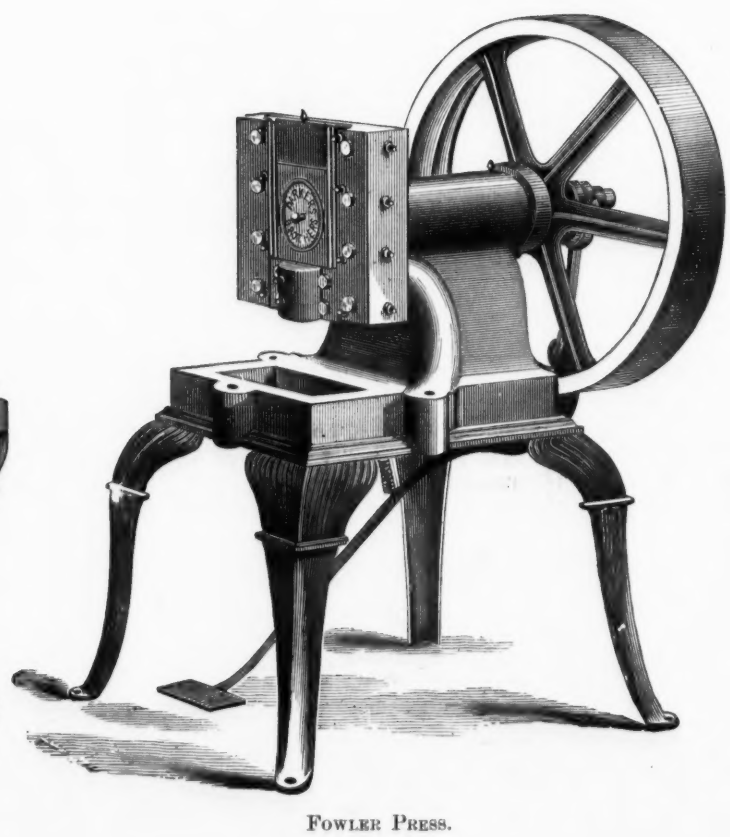


FIG. 2.

Fig. 1 represents the new graduated adjustment of the Stiles press. This provides for the rapid and certain adjustment of the downward travel of the punch, without consulting tables, or making any calculations whatever. Thus, supposing it is required to lower the stroke of the punch one-hundredth of an inch: The single bolt at the top is loosed, and by means of the hand-pinion shown the graduated circular wedge, or eccentric, is moved one division of the graduated scale; an operation, as will be seen, that can be very quickly performed. While the scale is graduated for advances by hundredths of an inch, it is evident that by setting between two graduations finer adjustments can be made.



STILES PRESS.



FOWLER PRESS.

The graduations being numbered a record can be kept for any particular dies used on regular work, and when again used these dies can be accurately set without loss of time. These features would appear to be valuable ones, and, particularly when a variety of work is done with a single press, must result in a large saving of time.

In setting the dies in this machine the shaft can be turned to bring the slide to the lowest point of stroke while the wheel is in motion, as the press cannot be started by accidental pressure upon the treadle, being prevented by self-actuating mechanism. The wheel can be turned backwards to release a punch that becomes fast in its die, or in fitting punches to dies, a feature the value of which will be recognized by those accustomed to use such machines.

The clutch pins, three in number, are arranged to lock at three different points in a revolution; consequently there can never be more than one-third of a revolution lost between the depression of the treadle and the starting of the press. The three clutch pins will manifestly last three times as long as a single one.

A positive stop is provided, which can be used or not, at will. This stop, when used, prevents the possibility of a second stroke, even if the foot is not removed from the treadle.

Fig. 2 represents the arrangement for changing the stroke of the slide, in addition to the adjustment previously referred to. The eccentric disk is secured to and revolves with the crank shaft. The stroke is adjusted by changing the position of the disk by means of a pin that enters the holes shown. This pin can be changed from hole to hole, thus accomplishing the desired end.

Fig. 3 represents the slide adjustment of the Fowler press. In this the adjustment is made by turning the eccentric ring. The crank-pin revolves in the hole in the eccentric block, and imparts motion in a way that will be clearly understood. To adjust the punch a wrench is applied to the bolt head shown, and the eccentric brought into position to be moved by a wrench fitting the holes on

the face. By means of this the eccentric can be turned to vary the position of the punch by the finest gradations.

In the Fowler as well as in the Stiles press the thrust between crank and punch is received by solid unyielding metal, affording no chance for variation while in operation.

Master Car Builders' Association.

LIST OF SUBJECTS, WITH THE COMMITTEES APPOINTED TO REPORT THEREON AT THE ANNUAL CONVENTION TO BE HELD AT THE HYGEIA HOTEL, OLD POINT COMFORT, VA., BEGINNING TUESDAY, JUNE 9, 1885.

1. A Standard Form for the Treads and Flanges of Wheels.—The report of this committee to include a recommendation of a maximum and minimum limit gauge for the flanges of wheels and cars received for interchange. H. Stanley Goodwin, Lehigh Valley Railroad, Bethlehem, Pa.; M. N. Forney, 73 Broadway, New York; R. C. Blackall, Delaware and Hudson Canal Company, Albany, New York; John W. Cloud, Pennsylvania Railroad, Altoona, Pa.; Herbert Wallis, Grand Trunk Railway, Montreal, Canada.

2. Standard Freight Car Trucks.—Resolutions were adopted at the last convention instructing the committee to "present to the convention in another year what they would recommend as a standard truck for cars of 40,000 pounds' capacity, and that a standard freight car truck should be of the diamond form * * * and should have cross channels so that it may be used with a swinging bolster or rigid bolster, * * * and that it is the sense of the meeting that a five-foot wheel-base would be accepted, * * * and that the Master Car Builders' journal is large enough for cars whose capacity does not exceed 40,000 pounds." The committee were also instructed to use the Master Car Builders' standard journal bearing and journal box in the trucks for cars not exceeding 40,000 pounds' capacity. Robert Miller, Michigan Central Railroad, Detroit, Mich.; William McWood, Grand Trunk Railway, Montreal, Canada; William Forsyth, Chicago, Burlington and Quincy Railroad, Aurora, Ill.; Joseph Wood, Pennsylvania Company, Ft. Wayne, Ind.; J. N. Barr, Chicago, Milwaukee and St. Paul Railroad, Milwaukee, Wis.; Henry S. Bryan, Chicago and Iowa Railroad, Aurora, Ill.

3. Brake Shoes, Brake Beams, and Interchangeable Parts of the Brake Arrangements of Cars.—This committee was continued, with instructions to submit a definite form of brake shoe, brake beam, and of the interchangeable parts, for adoption at the next annual convention. L. Packard, New York Central and Hudson River Railroad, West Albany, N. Y.; John S. Lentz, Lehigh Valley Railroad, Packerton, Pa.; and J. W. Marden, Fitchburg Railroad, Boston, Mass.

4. Standard House Car to Carry 60,000 Pounds of Lading.—The committee on this subject was continued and was united with the Committee on Freight Car Framing and Trussing, with instructions to report on a definite form of framing and trussing, for adoption at the next annual convention. H. Stanley Goodwin, Lehigh Valley Railroad, Bethlehem, Pa.; John W. Cloud, Pennsylvania Railroad, Altoona, Pa.; Leander Garey, New York Central and Hudson River Railroad, Grand Central Depot, New York; F. M. Wilder, New York, Lake Erie and Western Railroad, Susquehanna, Pa.; L. Packard, New York Central and Hudson River Railroad, West Albany, N. Y.; Wm. McWood, Grand Trunk Railway, Montreal, Canada; R. McKenna, Delaware, Lackawanna and Western Railroad, Scranton, Pa.; R. H. Soule, New York, West Shore and Buffalo Railroad, Frankfort, N. Y.

5. Standards and Appliances for the Safety of Trainmen.—This committee was appointed in accordance with the following resolution:

Resolved, That a committee be appointed to prepare a circular calling the attention of railroad managers to the standards and the appliances for the safety of trainmen, which have been recommended by this association, and that this committee be urged to do everything in their power to secure their adoption.

John Kirby, Lake Shore and Michigan Southern Railroad, Cleveland, O.; B. K. Verbryck, Chicago, Rock Island and Pacific Railroad, Chicago, Ill.

6. Passenger Car Framing and Trussing.—Thomas A. Bissell, Barney and Smith Manufacturing Company, Dayton, O.; William Forsyth, Chicago, Burlington and Quincy Railroad; Robert Miller, Michigan Central Railroad.

7. Automatic Freight Car Brakes.—Godfrey W. Rhodes, Chicago, Burlington and Quincy Railroad, Aurora, Ill.; George Hackney, Atchison, Topeka and Santa Fe Railroad, Topeka, Kansas; B. Welch, Central Pacific Railroad, Sacramento, Cal.

8. Freight Car Roofs.—F. M. Wilder, New York, Lake Erie and Western Railroad, Susquehanna, Pa.; R. C. Blackall, Delaware and Hudson Canal Company, Albany, N. Y.; and D. Hoit, Gilbert Car Manufacturing Company, Troy, N. Y.

9. Trap-doors in the Roofs of Passenger Cars.—This committee was continued and was requested to furnish plans at the next annual convention. F. D. Adams, Boston and Albany Railroad, Allston, Mass.; John Mackenzie, New York, Chicago, and St. Louis Railroad, Cleveland, O.; Sanford Keeler, Flint and Pere Marquette, East Saginaw, Mich.

10. Side-Dumping and Drop-Bottom Coal Cars.—Joseph Townsend, Chicago and Alton Railroad, Bloomington, Ill.; John Hodge, Missouri Pacific Railroad, St. Louis, Mo.; and C. E. Gore, Lafayette Car Works, Lafayette, Ind.

11. Standard Dead Blocks.—This committee to submit detailed drawings to be adopted as standards by the association. Charles Blackwell, Norfolk and Western Railroad, Roanoke, Va.; Geo. W. Demarest, Northern Central Railroad, Baltimore, Md.; M. N. Forney, 73 Broadway, New York.

12. The Comparative Advantages of the two Methods of Constructing Freight Cars, with and without Platform Timbers or End Sills projecting from the End of the Car.—E. B. Wall, Pittsburgh, Cincinnati and St. Louis Railroad, Columbus, Ohio; B. K. Verbryck, Chicago, Rock Island and Pacific Railroad, Chicago, Ill.; Geo. W. Cushing, Northern Pacific Railroad, St. Paul, Minn.

13. Subjects to be Reported at the next Annual Convention for Investigation and Discussion at the Succeeding Convention.—R. H. Soule, New York, West Shore and Buffalo Railroad, Frankfort, N. Y.; Sanford Keeler, Flint and Pere Marquette Railroad, East Saginaw, Mich.; James N. Lauder, Old Colony Railroad, Boston, Mass.

14. Committee of Arrangements for the next Annual Convention.—M. M. Pendleton, Seaboard and Roanoke Railroad, Portsmouth, Va.; J. W. Fleming, Petersburg Railroad, Petersburg, Va.; John S. Whitworth, Norfolk Southern Railroad, Norfolk, Va.

Disputing Eli Whitney's Rights.

A writer in a recent issue of the *Franklin Institute Journal*, who is evidently troubled in spirit lest United States mechanics should be awarded credit for originating any valuable productive system, disputes the claim that Eli Whitney was father of the interchangeable system of machine work. To substantiate his denial of what has become a recognized honor to an American mechanic, this correspondent rakes up an extract from the notes of travels in Siberia in 1742, where an author mentions that at Ije, where there was a Russian arsenal, every piece of armory work was made according to a model. The instance given may be true, and if the objector digs deeply into ancient lore, he may have the gratification of proving that the Romans made measuring vessels after an exact model, so that all were exactly the same size. That may have suggested to Eli Whitney the advisability of making parts of fire arms interchangeable, but it was equally open to others who had not the ability to perceive the mechanical advantages of making pieces the same size. The Russian mechanics may have adopted the idea prior to Whitney, but they certainly did not become the disseminators of the system. The world recognizes as the inventor of a device the man who puts it in shape fit for practical application. Whitney worked out the interchangeable system and applied it to ordinary shop work, and after his methods were long applied in various departments of machine work in America, they were introduced into British armories, which served to make the system known in Europe. That an obscure shop may have practiced something of the system half a century before it was developed by Whitney, no more diminishes his honor than the fact that the Greeks moved a toy by steam detracts from the honor Newcomen is entitled to for making a steam engine that could be successfully used for industrial purposes.

An Unprotected Manufacture.

The American Tinned Plate Association, of which Wm. J. Lewis is President, T. B. Everson, Treasurer, and John Jarrett, General Agent, has issued the following circular from its headquarters in Pittsburgh, Pa. The present tariff on tin plates is for revenue exclusively.

"During the fiscal year ended June 30th, 1884, the United Customs Records show the Importations of British (so-called) 'Tin Plates, Terne Plates and Taggers Tin,' have amounted to 507,894,756 pounds, valued at $18,182,637 at Liverpool. This amount added to freights paid thereon to British steamship lines, and insurances paid thereon to British insurance companies, has caused an outflow of more than $20,000,000 gold from the United States to Great Britain during the past year.

"American Consumers pay prices indicating a yearly expenditure of about $30,000,000 for these British tinned and leaded forms of sheet iron and steel. $30,000,000 represents the labor of not less than 75,000 people in the United States for a year.

"This branch of iron and steel production has been totally suppressed and prohibited in the United States by unprotective 'revenue only' rates of Duty, varying from 15 per cent. *ad-valorem* to $1\frac{1}{10}$c. per pound—at present 1c. per pound. The business has been controlled by a few large importing firms and British agents, composing the 'Tin Plate Monopoly' in the United States.

"Unprotected by home competition, American householders have been notoriously swindled by miserable materials, inadequate coating, and false branding.

"Influenced by popular indignation, and a well grounded apprehension that this Association is certain to secure from Congress 'fair play' to American manufacturers, and relief to American consumers from foreign tin plate impositions, by the enactment of protective duties on 'tin plates' and 'taggers iron,' these British manufacturers and their American stool pigeons, the importers, have advertised a so-called 'reform' the principal features of which, so far, have been a confession of past sinful practices on the one hand, while using the 'reform' as a lever with which to obtain larger profits from American consumers, on the other hand, by extra prices for special brands and crosses. It is a 'Heathen Chinee' business wherein the 'crosses' crown the innocent philanthropic importer. The American people can have no permanent relief nor security from future impositions, except through a development of American manufacturing competition by protective duties.

"The dishonest and treasonable character of so-called 'revenue reformers' in and out of Congress, is exhibited in their unanimous refusal to accord 'fair play' to this important industry, and thus aid to upbuild the material wealth and prosperity of the American people.

"If made in the United States they would be produced by and paid for in the *labor* of our own people, while over $20,000,000 would be saved from going to Europe annually, and added to the permanent wealth of the nation every year.

"A better idea of the magnitude of this industry, and how it would stimulate railroad transportation and other interests is exhibited by the following statement showing what would be necessary to produce them annually in the United States—approximate.

"850,000 tons iron ore; 300,000 tons lime stone; 1,500,000 tons coal; 300,000 tons pig iron; 5,000,000 bushels charcoal; 5,000,000 pounds lead; 25,000,000 pounds tin; 10,000,000 pounds tallow; 10,000,000 feet lumber; 30,000,000 pounds sulphuric acid; $12,000,000 labor in tin plate works alone.

"The interest on $30,000,000 capital to be invested in the construction of mills and machinery; $1,000,000 annually for repairs; $100,000 for oils and lubricants; $1,000,000 for insurance and taxes.

"The necessaries of life for 300,000 people supported by the industry.

"National wealth can only be created by labor in production and in utilizing our own 'raw materials' with which God has blessed our land.

"American tin and terne plates are wanted, and must be had.

"A Protective Tariff is essential and will benefit the American consumer and manufacturer mutually."

Industrial Experiment in France.

What we should call a Social Science Congress was recently held at Blois, in France, at which, among other things, some very interesting statements were made concerning the experiments which have been tried to promote the improvement of the material and moral condition of workmen, by admitting them to participation in the profits of the business or manufacture which they help to carry on. The first person to apply this important principle in actual business seems to have been the great Leclaire, a workman by birth and training, who, having entered into business on his own account, with a small capital saved from his earnings, was inspired with the idea of using his limited opportunities to put in practice a theory about which he had thought much. He was himself but recently emancipated from the dull and hopeless drudgery of a journeyman, and could feel how much his new responsibility as a master increased his energy, and with it the amount of work which he could do in a given time, and he resolved to try whether the application of this stimulus might not be made on a small scale for the benefit of his men as well as himself. Wild as this scheme seemed to his friends, Leclaire carried it out, on a small scale at first, but later on a large one; and without, so far as he could see, any loss to himself, he succeeded in improving greatly the material as well as the moral condition of those whom he employed, and left an example which is every year more generally followed.

After Leclaire's first successful experiment, two gentlemen, M. de Courcy and M. Charles Robert, undertook to diffuse the knowledge, and, if possible, the repetition of it, in the industrial world, and it is perhaps owing partly to their exertions that about eighty French manufacturers or contractors now deal with their workmen on this principle, and within the last six years has been established a society for the practical study of the methods of participation by employes in the profits of business. Among the enlightened employers who pursue this system is M. Chaix, the proprietor of a renowned Parisian printing office, which maintains twelve hundred workmen and keeps more than a hundred presses in operation, and the discussion of the subject at the Congress of Blois was signalized by the reading of an admirable paper by him. Before speaking of his own establishment, M. Chaix remarked that many difficulties interfered with the application of a system of participation, the most serious of these being, perhaps, the inability of workmen without capital to bear any share of the losses which fall to the lot of most business men; so that it is necessary, in order to protect the employer, who furnishes the capital, from the danger of giving away all the profits in good seasons, and bearing the burden of all the losses in bad times, to arrange for reserving a fund for contingencies. This is easily done, and may

prevent the total collapse, in an unfavorable year, of an experiment begun with entire success. The form of participation is also unsettled, the practice of different houses varying greatly. Some pay over in cash to each workman his proportionate share of the profits at the end of each year; while others pay nothing in cash but reinvest each man's profits in the business, securing thus for him, without his control, compound interest on his earnings. The best course, M. Chaix thinks, lies between these two. As he well says, although the principal end of participation is to encourage habits of prudence, order, responsibility, and economy, it is not best to push benevolence to austerity; and the most successful system is found to be one in which a portion of each man's share of the profits is paid over to him in cash at the end of the year, to serve as an immediate reward for the industry of the year and as a stimulant to renewed saving and effort, while the rest is invested in his name and for his benefit. The dividend is paid annually, one-third in cash, one-third as a credit on a reserve fund, the whole of which can be drawn out when the man leaves the office; and the remaining third as a credit on a sort of superannuation and insurance fund, which can only be drawn at the age of sixty, or after twenty-five years of service, or in case of death, when it is paid over to the heirs of the deceased man. Credits on both these reserved funds bear interest at the rate of 4 per cent. per annum. The average dividend paid to the men in the Chaix establishment for the last twelve years has been about 7½ per cent. upon the amount of their wages, and the total sum paid to them in this way during that time is $140,000. In regard to the effect of the system upon the workmen, M. Chaix says that its tendency to encourage economy and prudence is shown by the fact that about one-half of the sum paid in cash every year is at once invested by the men in savings banks or in life insurance policies; and it is also remarkable that during the printers' strike of 1878 only sixty-two men, out of the whole number employed, quitted their places, and not one of these was a participant in the profits.—*American Architect.*

Explaining the Business Depression.

In closing a dissertation on "The Business Depression," the *National Car Builder* says:

"These considerations seem to be sufficient to show that the prevailing dullness is the effect of very obvious and adequate causes, and that no very decided change for the better can be looked for while the existing conditions continue."

This reminds us of the old story of two men discussing the weather. One said: "The wet spell we now have is evidently the direct result of an excess of rain;" whereupon the other replies: "Yes, you are doubtless correct, and I think we can safely say that we shall have no very decided dry weather as long as the wet spell continues."

A novel feature in engineering has come to our notice. We say novel, because it is so unusual as to attract peculiar attention. It is a list of clients of Geo. H. Barrus, consulting steam engineer, of Boston, for the last four years, with an inventory of the various jobs done for them. Then there is an enumeration of the different boilers and engines tested, with totals (by number) of engine and boiler tests. This circular (which is an imposing one) suggests an idea to lawyers. Why should lawyers not publish a list of their clients and the cases for which they were engaged? The form, following that of Mr. Barrus, would be something like this: "John Hayseed; defending line fence suit brought by Brown; counsel in damage suit arising from Smith's hog breaking into cornfield; attorney in suit against railroad company for killing cow; letter of advice." In these days of new and improved methods of advertising, lawyers may gather a few points from some engineers.

Query: Have any of our readers heard from Fink and his lubricating humbug lately?

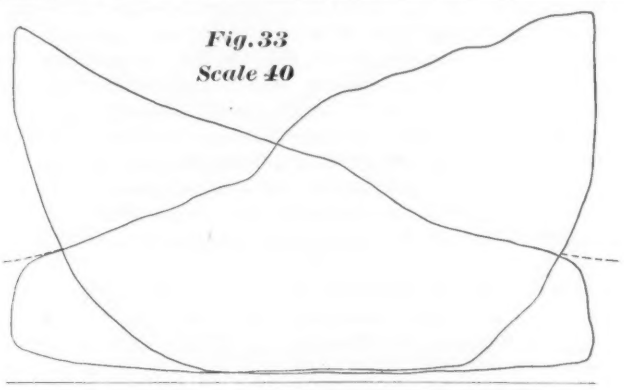


Fig. 33
Scale 40

The Indicator Diagram.

By F. F. Hemenway.

DIAGRAMS TAKEN DURING THE TEST OF A LAP-VALVE ENGINE.

The pair of diagrams represented in Fig. 33 were taken from a Westinghouse engine during a test made to determine the water required per horse power per hour. The diagrams are instructive when considered in connection with the results obtained from the test, as well as otherwise.

The engine was a 7″x7″, running at a speed of 293 revolutions per minute, boiler pressure 95 lbs. The cut-off was at about half stroke, by lap-valve; regulation by throttling governor; clearance .072 per cent.

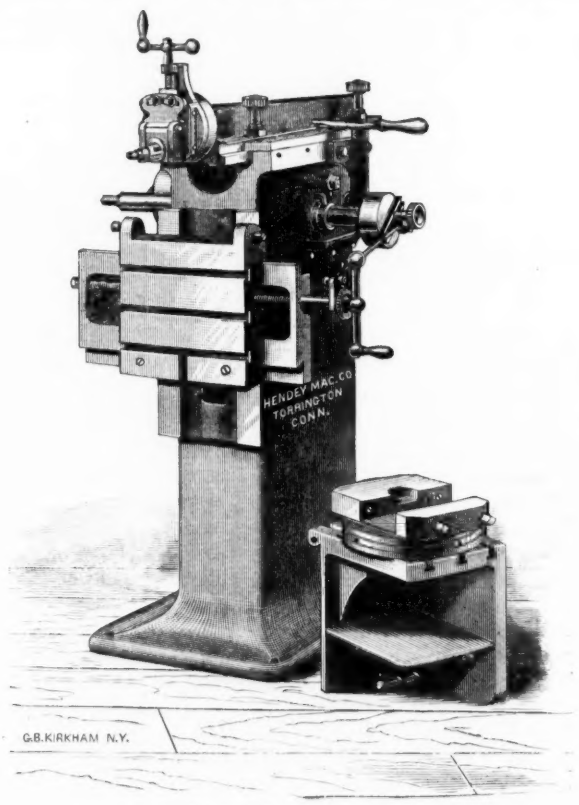
The average mean effective pressure during the test was 44.13 lbs.; indicated horse power 17.54, brake horse-power 15.53, making the loss from friction a little less than 11.5 per cent.

The water supplied to the boiler was 34.36 lbs. per indicated horse-power per hour, or 38.8 lbs. per brake horse-power. Of this about 80 per cent. was accounted for by the indicator, the remainder being chargeable to condensation, and leakage, if there was any.

Steam was supplied from a boiler having a grate surface of 4.9 square feet and 80.6 feet of heating surface. The boiler efficiency was 9.44 lbs. of water evaporated from and at 212° per pound of coal.

These results from so small an engine were remarkably good, and show what can be done when the conditions are favorable. An inspection of the diagrams will show why such results were possible. The power developed—more than 17 horse-power—was large, which would be certain to reduce the percentage of loss from condensation. The steam pressure being high, the operation of the governor was to bring about considerable initial expansion, which coupled with the expansion provided by cutting off with the lap of the valve, makes a very fair expansion diagram, resulting in a mean effective pressure considerably above the absolute terminal pressure. It will be observed that the early cut-off by the single valve does not, as it is sometimes claimed that it will, distort the diagram, the exhaust opening being none too early, and the compression none too much for the initial pressure and clearance.

Calculating from the two diagrams shown, the mean effective pressure is 43.5 lbs.—a little less than the average during the test. The terminal pressure is a little less than 41 lbs., and the water accounted for by the indicator, at the end of the stroke, 28.5 lbs. per indicated horse-power per hour, 20 per cent. more water being used than is accounted for by these diagrams. It will be seen that the diagrams agree remarkably well with the results of the tests, and that a very close estimate would have been made from their consideration alone.



NEW 15-INCH SHAPER.

New 15-Inch Shaper.

The engraving represents a new shaper by the Hendey Machine Company, Torrington, Conn. It has a stroke of 15″, the cross-feed has a range of 15″, and it will plane a piece 12″ in height. The machine is a strong one of its class, and, as well as general work, is especially adapted to tool-making and all kinds of die work.

It is provided with a new reversing movement, giving the positiveness of a crank motion, with facilities for changing the length of stroke while the machine is in motion. This movement is simple in construction, with no parts liable to get out of order; it should last as long as any other parts of the machine.

The adjustable table is so arranged as to be quickly set to plane work at any desired taper. This table can, as shown, be easily removed, when work reaching to the floor may be clamped to the saddle.

The vise is graduated, has steel jaws, and will take in work 4″×8½″.

When desired, centers and extra table are furnished with the machine. Weight, 1,100 lbs.

A Heroic Engineer.

Engineer James Skuse, of the Atchison Topeka and Santa Fe Railroad, performed quite a heroic feat the other day and saved the purses of the passengers in a train he was pulling, at the iminent risk of his life. When approaching Socoro, N. M., one moonlight night he perceived an obstruction on the track and by means of prompt use of the air brake and reverse lever, stopped before he struck it. He stopped too in the middle of a band of train robbers who had taken this means of stopping the train they meant to plunder. From both sides of the track he received orders to step down, but instead of obeying he pulled open the throttle and forced the engine through the obstruction amidst a shower of bullets. Fortunately the pilot pushed the rocks and ties laid on the track clear of the rails and the train passed over. The robbers fired into the coaches and nearly every window was broken, but no one was hurt. Had the obstructions thrown any part of the train off the rails, the miscreants who were out for robbery would have made short work of killing James Skuse.

A Badly-Conducted Labor Bureau.

The *Iron Age* notes our recent strictures upon the inefficiency of the New York State Bureau of Labor Statistics, and says:

"If the facts are as stated by our contemporary, there is certainly a necessity for vigorous work by those who have been placed in charge of the labor interests of this State. The position of commissioner should not be a sinecure, but should be filled by a conscientious person fully capable of dealing with the delicate questions arising from the relations of capital and labor, having neither prejudice against the one nor an undue desire to please the other, but quick to discern evidences of unjust treatment by employers of those who have to toil laboriously for their daily bread, and prompt to lay the proofs before the Legislature for remedial action."

Now that the elections are over, it is to be hoped that Charles F. Peck, chief of the New York State Bureau, will be relieved sufficiently from political machine work to devote enough attention to the duties of his office to produce results of some value to the industries of the State. The bureau was established over a year and a half ago, and we have not heard of anything yet accomplished by it, although we have written to the commissioner for information. On the same day we wrote to the Railroad Commission, and received copies of their report promptly. No reply came from the Labor Bureau.

We are glad to know that our efforts to have the inefficiency of the Labor Bureau, under its present management, brought to public attention, have been seconded by one of our esteemed contemporaries, and are confident that, if the whole industrial press of the State would aid in disseminating the facts, a much-needed reform would be made in that bureau. The greatest reform would be to appoint a new and efficient commissioner to conduct the work the bureau was established to perform.

In France all shops and factories where children are employed are subject to inspection. No child must work until the completion of its twelfth year; the hours are limited to twelve, and night work is forbidden. Between the ages of 11 and 15, children can work but six hours in the day, and must attend school during the other six, unless they can show a certificate of previous elementary education.

Speaking of Birmingham, Eng., it is said: "Though great improvements have taken place in the last ten years, there still remain too many places which should be improved off the face of the earth. Some of the so-called 'mills' in Birmingham, which perhaps hold from twenty to forty tenants, are hopelessly miserable places, and must exercise a very depressing and demoralizing influence upon the poor people who have to work in them."

It is said that the Woodin Manufacturing Company, of Berwick, Pa., is now trying a most novel temperance movement for the benefit of its mills. They have agreed to pay the three hotels in that place the equivalent of their probable profits for a year in the sale of liquors, provided they will not apply for licenses and will not sell intoxicants. The theory of the company is that it can afford to pay the several thousand dollars which this experiment will cost for the sake of the benefits which it will derive from having sober and reliable help.

Balancing the Running Parts of Steam Engines.

BY J. C. HOADLEY.

The forces which come into action in a steam engine, and require balancing in order to secure steadiness and smoothness of motion, are of three kinds—rotatory, reciprocatory and mixed. All depend for the degree of importance they assume upon the velocity at which the engine runs. At very low speeds but little inconvenience is felt even when no attempt is made to balance the running parts, while high speeds require the nicest balancing, the effect of unbalanced parts increasing as the squares of the velocities, say, as the squares of the number of revolutions per minute. All revolving parts, such as crank disks, fly-wheels, pulleys, eccentrics, etc., may be perfectly balanced, and, as far as practicable, should be balanced each one by itself, and each part of each one by itself. It is not enough that a fly-wheel be so balanced that it will have no tendency to turn when at rest. The method once common, and not yet obsolete, of placing the shaft on leveled straight edges, and attaching weights to the rim until the wheel is in standing balance, is, as is generally known, almost as likely to aggravate an evil as to remove it. Each edge of the rim should be separately balanced, and the arms as well. When in proper running balance, it will be in perfect standing balance also, but the converse is not true. An article in the AMERICAN MACHINIST, Vol. V., No. 37, for September 16, 1882, page 5, by F. F. Hemenway, describes a clever apparatus for balancing pulleys. Unless the speed is very high, it will not be necessary to resort to such refinements, but the counterbalance should be so applied as to balance each edge of the rim as nearly as possible. Except for very high speeds, it is not practically important to balance the eccentric, but the metal ought to be so distributed as to balance it as nearly as convenient.

In the ordinary horizontal engine, having a crank of cast or wrought iron fitted on the end of the crank-shaft, there is no way to balance the crank. Putting counterbalances upon the fly-wheel will do only harm; it will *not* balance the crank, and it *will* throw the fly-wheel out of balance. In engines with cranked shafts, having a bearing each side of the crank, and two overhung pulleys, as in some portable engines, a slight advantage may be gained by partly counterbalancing the crank by weights divided between the two pulleys. A counterbalance cast on the crank is efficacious, but is usually uncouth in appearance. A crank disk affords satisfactory facilities for counterbalancing the crank, crank-pin, and that portion of the connecting rod which shares the rotatory motion of the crank. Double crank disks are still better in this respect. The counterbalance for the connecting rod should be in the plane of oscillation of the rod—of revolution of the crank-pin end—but that is impossible. The best thing possible is to divide the balance weights between two crank disks, and the next best thing is to put the proper weight upon a single crank disk, or upon a counterbalance cast with the crank.

The connecting rod comes under the third head—mixed forces. Its whole weight exerts reciprocatory force, and should be added to the weight of piston, piston rod and crosshead, which together constitute the "reciprocating parts" of an ordinary horizontal engine. These parts must remain unbalanced, unless equal masses can be set in equal and opposite motion, as in the Wells engine; but they can be rendered harmless, and even useful, by judicious management of compression and lead. Harm, rather than good, will be done by attempting to balance the reciprocating parts by putting counterbalancing weights on the balance wheel or on crank disks, single or double. But, while the *whole* weight of the connecting rod belongs to the system of reciprocating parts, a *part* of its weight belongs also to the crank, and this rotatory portion of the force it exerts may be balanced in all cases where the construction admits of balancing the crank itself. The reason why the whole weight of the connecting rod belongs to the reciprocating parts, and a part of its weight also to the crank, is that the connecting rod has more motion than the piston, piston rod and crosshead, in consequence of its crank-pin end being carried around half the circumference of a circle, while its other end, attached to the crosshead, moves a distance equal to the diameter of the same circle. This excess of motion is $\frac{\pi}{2} - 1, = 0.57$, say, 57 per cent.; but only the crank end has all this excess of motion, the rest of the rod sharing it in a diminishing degree till the crosshead end is reached, where the motion is purely reciprocatory. Fig. 1 shows the paths of certain points in the length of a connecting rod having a length equal to five times the length of the crank.

We will call the lengths of the crank unity, one foot, if you please. $A\ B$, then, the stroke is 2 feet; $A\ L = B\ N$ is the length of the connecting rod, = 5 feet; and $L\ H\ N\ H'$ is the path of the crank-pin center $= 2' \times \pi$

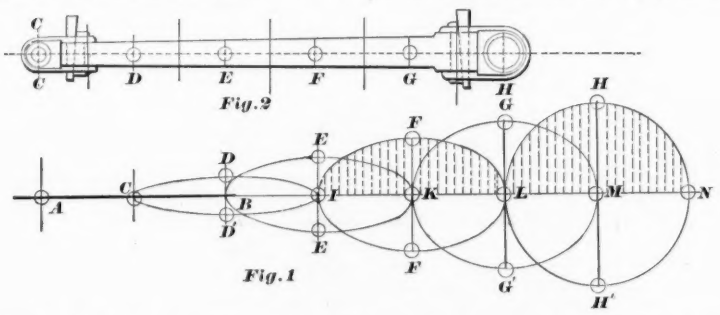


Fig. 2

Fig. 1

= 6.2832 feet in circumference. If we assume the rod to be of uniform size throughout, and divide it into six parts, four central parts each 1 foot long, and the two end sections each 0.5 foot long, the crosshead end may, without essential error, be assumed to have only reciprocatory motion between A and B, and the crank-pin end to have rotatory motion around the path of the crank-pin, $L\ H\ N\ H'$. These two parts are, by hypothesis, of equal weight, represented by the small circles A and H. If, now, we assume the weight of each of the central parts, each one foot long, to be concentrated in its center, represented by the small circles D, E, F and G, each one of these parts will describe the elliptical path upon which it is shown in the figure, while A moves to B and back again along the same straight path, and while H describes the circle $L\ H\ N\ H'$. The transverse axis of each ellipse, $C\ I$, $B\ K$, $I\ L$ and $K\ M$, is equal to the stroke, $A\ B$, and to the diameter of the circle of crank-pin motion, $L\ N$.

The length of the conjugate axis, or width of the ellipse, will be proportioned to the distance of the describing point from the crosshead-pin center: $D\ D' = \frac{1}{6}\ H\ H'$, $E\ E = \frac{2}{6}\ H\ H'$, $F\ F = \frac{3}{6}\ H\ H'$, and $G\ G' = \frac{4}{6}\ H\ H'$. The value of the rotative part of the weight will be proportioned to the area of each ellipse divided by the area of the circle $L\ H\ N\ H'$. Of the three factors which go to make up these areas, two are constant, namely, the length of the transverse axis, equal to the stroke of the engine, and $\frac{\pi}{4} = 0.7854$. It, therefore, follows that the value of the rotative part of the weight is directly proportional to the sole remaining factor—the length of the conjugate axis—which, in turn, is directly proportional to the distance of the weight from the center of the crosshead-pin, equal, as we have seen, to $\frac{1}{6}$, $\frac{2}{6}$, $\frac{3}{6}$ and $\frac{4}{6}$ of the stroke respectively. But part of this force is exerted on the slides through the crosshead, and only the remainder is exerted on the crank-pin, and can be considered as a rotative force; and this, again, is directly proportional to the distance from the center of the crosshead-pin. Combining these ratios, we have as a result that the rotative part of the weight is directly proportional to the squares of the distances from the crosshead-pin center:

$$C = \ldots\ldots\ldots\ldots\ldots 0$$
$$D = \tfrac{1}{6}{}^2 = \ldots\ldots\ldots\ldots\ldots \tfrac{1}{25}$$
$$E = \tfrac{2}{6}{}^2 = \ldots\ldots\ldots\ldots\ldots \tfrac{4}{25}$$
$$F = \tfrac{3}{6}{}^2 = \ldots\ldots\ldots\ldots\ldots \tfrac{9}{25}$$
$$G = \tfrac{4}{6}{}^2 = \ldots\ldots\ldots\ldots\ldots \tfrac{16}{25}$$
$$= 1.2$$

Each part will be one-fifth of the weight of the connecting rod (upon the assumption that the rod is of uniform size throughout), or the actual weight of each section may be estimated. The combined effect of the four intermediate sections will therefore be 1.2 times $\frac{1}{6}$ of the weight of the rod, = 0.24, to which add the weight of the crank-pin end, equal, by hypothesis, to $\frac{1}{10}$ of the weight of the rod, and we have $0.24 + 0.10 = 0.34$.

A little more than one-third of the rod, therefore, must be considered as concentrated at the crank-pin, and as revolving with it, if the rod be of uniform size. If the rod be heavier at the crank end, the proportion will be greater, and may amount to one-half.

Except for extremely high speeds no great refinement will be necessary, and the proportion may be taken at 35, 40, 45 or 50 per cent. of the weight, according to the form of the rod. Whatever it is, it should be balanced upon a crank disk or crank balance, if the engine has one, or upon the two disks if the engine has double crank disks, just as if so much weight were really added to the crank-pin itself. It will be worse than useless to attempt to balance this force by putting counterbalances on the fly-wheel, since such counterbalances would make the fly-wheel "throw" in one direction, and leave the rotatory weight of the connecting rod to "throw" in the opposite direction. It may be remarked in passing that the "throw" of any unbalanced rotating mass is towards the *light* side of the mass, and is nothing else than the effort of the mass to revolve about an imaginary axis passing through its own center of gravity, which is one side of the rigid axis of rotation, and always on the *heavy* side of the revolving mass, and to bring this imaginary axis to coincide with the rigid axis.

This matter is very clearly explained in a little "Treatise on the Art of Balancing the Rotating Parts of Machinery, together with the Laws Governing the Rotations of Bodies with which Mechanics are Familiar. Deduced from Experiences by the Defiance Machine Works, Defiance, Ohio." A careful perusal of this little treatise of only 36 small pages will be found instructive by most machine builders.

I have studiously avoided everything like a mathematical treatment of the subject, and confined myself to the simplest language. An interesting and instructive article on the subject of balancing locomotive engines, by C. A. Smith, B. S., Fort Wayne, Ind., will be found in Van Nostrand's *Engineering Magazine*, Vol. XXIII., July, 1880, p. 9. I think Mr. Smith is in error as to counterbalancing the reciprocating parts by weights applied to the wheels, although the case of the locomotive is peculiar, and it may be judicious to sacrifice something in the smoothness of revolution of the wheels for the advantage of reduced lateral oscillations of the engine. A much smaller ellipse of oscillation than Mr. Smith gives ($2\frac{1}{4}$"x$1\frac{1}{2}$") is ascertainable. I have obtained a figure which could be circumscribed by a circle of less than one inch diameter.

An Account of the Experimental Steel Works at Wyandotte, Mich.

BY W. F. DURFEE.

This paper, read by its author at the meeting of the Society of Mechanical Engineers, is interesting, but is too long for reproduction in our columns; so we abstract the leading points.

In 1862 Captain E. B. Ward, of Detroit, was associated with the late Z. S. Durfee in the work of testing by experiment on a large scale a process for the production of steel, invented by William Kelly, of Kentucky. In connection with this prospective business of steel making, Z. S. Durfee went to Europe to try and purchase the United States patent for the Bessemer process, which was essentially the same as that invented by Mr. Kelly. At this time W. F. Durfee was invited to undertake the construction of experimental plant to test the process, and he undertook the work, although he had never seen a Bessemer plant. But he proceeded to possess himself of all information obtainable by securing copies of the patents issued to Bessemer for various forms of apparatus for the production of steel by the pneumatic method. He also obtained the first edition of "Fairbairn's History of the Manufacture of Iron," embracing all the information then accessible relative to the European practice of the new art.

With very little knowledge of an exact character as to what had been done by others, but with a very clear idea of the rationale of the new process, supplemented by an absolute faith in the great future before it, Mr. Durfee proceeded to evolve, from his own internal sense of the fitness of things, apparatus and methods suited to the general idea and environment of the proposed experimental works. Difficult as this task was, it was rendered almost insupportably burdensome by the pronounced antagonism and outspoken opposition of nearly every influential person in Wyandotte. So little faith had the people of these regions in making steel by a direct process, that Mr. Durfee had been but a short time in Wyandotte before he came to know that he was regarded as little better than a mild sort of lunatic, or as a confirmed idiot who might be tolerated, but not for a moment assisted, still less encouraged.

Notwithstanding the delays and annoyances caused by the multitudes of antagonisms encountered on every hand, the work progressed, and a converter was constructed which Mr. Z. S. Durfee, on his return from Europe, declared looked very like converters he had seen abroad. The blowing engine was completed in 1864, and several experimental blows were successfully made. Part of the arrangements connected with the converter was that a well was provided for any steel that might remain fluid in the casting ladle in case its tap hole should chill. With this well is associated a comedy, which came unpleasantly near being a tragedy. After several conversions had been made in the works, Mr. Durfee was called to Chicago, and left Wyandotte with the intention of being absent about a fortnight. Having no expectation that the works would be operated until his return, he left his assistant for the time being charged with the supervision of certain repairs, among which was the relining of the converter, an event which occurred at unprofitably frequent intervals. The first knowledge that Mr. Durfee received that his assistant had got into trouble at Wyandotte was conveyed in a letter from Captain Ward, which ran as follows:

"DEAR SIR: I wish you would come immediately to Wyandotte and look after that man X—— of yours. He will kill somebody by-and-by. (Signed) Yours truly,
"E. B. WARD."

He returned at once to Wyandotte, and ascertained that his assistant, at the request of Captain Ward, had attempted to run the

works for the benefit of a large excursion party that he had brought down from Detroit on one of his steamers. With this party were Senators Wade and Chandler, together with sundry judges, bankers, and merchants of repute. In showing this company how the work was done, Mr. Durfee's assistant was unfortunate enough to have the tap hole of the casting ladle chill after successfully turning two ingots, and he directed the ladle to be emptied in the well, which he neglected to fill with water; and the result of turning two tons of fluid steel upon about a *barrel* of water, which chanced to be in the well, was a terrible explosion, the metal flying in all directions. Senator Chandler was prostrated at full length in the pig bed; Senator Wade was projected upon a pile of sand in a corner of the casting house; others of the party were more or less burned and otherwise injured, while Captain Ward himself was blown bodily through the open doors of the building into the yard upon a pile of pig iron. For a time everything was confusion, but it was soon ascertained that by great good fortune no one of the visitors was seriously hurt, and they all returned to Detroit, thoroughly of the opinion that they did not care to see steel made by the "new process" again.

The first blow in these works was made in September, 1864, when the first Bessemer steel made in America was produced. This event was a great disappointment to the enemies of the new enterprise, as they had filled the air with predictions of failure and poisoned it with the miasma of discouragement, and they immediately turned their attention to a general depreciation of the results attained and the persecution with renewed vigor of all those who were responsible for them. The cause of progress, however, triumphed. Mr. Durfee concludes his paper as follows:

"In those early days the atmosphere in which I moved was heavy with the fog of discouragement. All the so-called practical iron men in the vicinity of Wyandotte were opposed to the new process. I well remember the sneers of contemptuous incredulity which greeted my statement that the time would come 'when a steel rail could be made cheaper than an iron one;' and now that that time has arrived, as I look back upon my work at Wyandotte, with the added experience of twenty years to aid the retrospection, I do not hesitate to claim that it was as good a solution of the problem presented as was possible under the circumstances of time and environment. Twenty years have elapsed since the first Bessemer steel was made in the experimental works at Wyandotte, and that time, improved by the labors of skillful men from among our engineers, metallurgists, and chemists, has wrought wondrous changes in the construction and management of our steel works, rolling mills and furnaces. Practices which were twenty years ago condemned as criminal extravagances, are now regarded as essential economies. Things deemed impossible by men of little faith then, are but the common occurrences of to-day. Buildings, machinery, methods, have all felt the influence of the spirit of progress. Science has become better acquainted with art, and art has a better appreciation of science; and their united forces are marching forever forward. Before their steady advance difficulties vanish, obstacles are surmounted, and seeming impossibilities are overcome; sound principles are established in place of empiricisms, and educated skill replaces laborious ignorance. Verily, 'old things are passing away, and all things are become new!'"

The paper on a "Novel Form of Hammer Die," by Mr. Hewitt, published in our last issue was read by the secretary and elicited discussion:

Mr. Hutton believed that the action of heat, and blows on the leather packing, between the end of the piston rod and the top of the die, to be such as within a few months to turn the leather into charcoal.

The president thought, from looking over the drawings, that there is one piece more than is necessary. If the rod is tapered and the conical end is dispensed with, make your tapering fit, and you have not got to make any allowance for shrinkage.

Mr. Davis thought the tapered piston rod would force itself down to the full extent of the blows, and the amount of inertia in the rod of the piston, every time, and it would probably upset itself badly. In their shops they had used hammers up to 250 pounds with the ordinary Sellers connection, and they have lasted five years. The piston head in every case comes right down solid against the hammer head, and does not seem to upset itself from this usage.

Condition of Philadelphia Manufacturing Industries.

The Philadelphia *Times*, of Nov. 13, gives an extensive account of the condition of manufacturing industries in that city. We condense the following particulars from that paper:

Work is going on in nearly every one of the thousand mills, factories and foundries in Kensington, but in no single case are all hands employed, and in not one instance are those hands who are engaged working full time. At Tacony, a placard on the great gates of Disston's saw works announces that with the exception of foremen and boys no hands will be needed in the works till further notice. "This action," says the same placard, "has not been caused by the late election."

In Frankford Mills the working forces have been cut down about one-half, and some of these are working half time.

Rowland's Spring Works employ only a hundred hands, against two hundred in active times.

Where a man used to get $1.40 he now gets $1.10.

The machinery works of H. W. Butterworth & Sons, at York and Cedar Streets, are very quiet. When times are good from 160 to 200 men find constant employment there. Now they have but 100 men. Their business depends upon the textile manufacturers.

"Things ain't so bad yet, yo' see," said a man with a strong Yorkshire dialect, who stood gazing at an idle foundry on Frankford road. "Every mon has laid by a bit for a rainy day, and though it do look a bit neet time like just noo, it wayn't last for ivver."

This man confidently informed the reporter that the tariff makes no difference to mechanics.

At the I. P. Morris Company's foundry, one of the largest in the city, the men are working only five days a week, and the force has been greatly reduced. No new orders are coming in, but they expect a better business after the opening of the new year.

At Cramp & Sons' shipbuilding yard there is one ship on the stocks, and in place of eighteen hundred men at work there are now only six hundred. They are working only five days and three-quarters a week. There are no orders, and have been none for six months, and the outlook is considered bad.

Bradlee & Co.'s chain works have 200 men at work on full time and full wages.

Several carpet mills are closed. In all, about 6,000 hands are unemployed in the districts of Kensington, Frankford, and Richmond. The people are generally hopeful of better business in the not distant future.

Business was never duller in the mills and factories in the southern part of the city. Idle men loiter on all the street corners. Short time is the rule in nearly all the mills, factories and shops that are not closed altogether.

Occasionally a cheerful mill owner was met. "There are over 300 hands employed here, all working full time, and some doing overtime. Orders are brisk and business just humming," said the superintendent of John Greer's woolen mill, at Sixteenth and Reed Streets.

The streets of Manayunk are full of idle men. Over 6,000 persons are out of work. Half of this number are men; the remainder is composed of women, girls and boys. All have been thrown out of employment since mid-summer by the shutting down of the cotton and woolen mills that have always been the mainstay of the masses of the 21st ward.

The Ripka Mills, the Campbell Mills, and Preston Mills are closed. The latter employ 500 hands when running.

Schofield's Mills, employing 1,300 hands, are running five days a week, and the owners say there is no money in running.

A time-keeper in the office of Dobson's mills said:

"Men working on looms average about $7 a week, and the overseers about $14 a week. Many of the loom men are only making $3 and $4 a week, and now hundreds of idle men would be glad to go to work for eighty cents a day."

During the summer, while the Manayunk Branch of the Pennsylvania Railroad was being built through Manayunk, many of the idle mill operatives found work, and bosses in the mills, who walked about with their heads high in the air, shouldered a pick and marched with the rest in the morning to grade the road-bed for a dollar a day. Manager Davis, of Campbell's mills, happened to see his head boss one day picking away at a tough stump. The man tried to hide his face from his old manager's gaze.

A saloon-keeper said lots of his old customers walk right by the door now.

Within a radius of half a square of the Reading depot the special officer at the station pointed out 28 saloons.

"All of them used to do a thriving business," he said, "but they're about half of them hanging on by the eyelids now. Men haven't got the money now, and those who are at work are afraid to drink, for fear that every day will be their last day's employment this winter."

LETTERS FROM PRACTICAL MEN.

Section of Locomotive Tires.

Editor American Machinist:

In your issue of last week Mr. Frank C. Smith describes, as a valuable improvement in rolling locomotive tires, a practice, which Mr. Black follows, of reducing the width of the tire tread by rolling the tire in the form of two steps. This is done to save the tires from wearing with a shoulder, and consequently it saves turning them off so often as where the whole width of tread is used. I would suggest an improvement on this by recommending the use of narrow tires without any second step, so that they will wear uniformly until they get so thin that they must be renewed. If my proposal is objectionable on the score that narrow tires would be more liable to drop off the rails, the same objection must stand against the practice followed by Mr. Black; for, should a tire of the section shown drop, so that the outer step rested on the rail, it would be very liable to spread the track and lead to derailment. In a case of this kind, however, practice is worth a good deal more than mere theory, and I should like to hear if the road using tires of the kind mentioned have no trouble from their locomotives leaving the track.

FOREMAN.

"A Question" Answered.

Editor American Machinist:

In answer to question of E. E. Bigelow, in your issue of November 8—the rod would spring out towards the arrow. Were the box to wear to the pin having the same angle, fitted at dead center, it would bind as soon as crank left that position.

SIDNEY WHITAKER.

Tendency of Tubes of Circular Cross Section to Straighten Themselves.

Editor American Machinist:

In your issue last week, referring to the invention of the Bourdon pressure gauge, you say that it "was based on the discovery that steam admitted into a closed curved tube tended to straighten it." This is not strictly correct, unless qualified by the statement, later expressed, that in its perfected form the tube had an elliptical cross section. Many gauges have the cross section of rectangular form. I wish to call attention to this expression, because, in the ordinary sense, a tube is taken to be circular in cross section, and, if the curved tube is circular in cross section, steam or fluid pressure does not tend to straighten it out. On the other hand, because it is not circular in cross section, and probably of equal thickness throughout, an internal fluid pressure does tend to make it circular, and this change of form from rectangular or elliptical to circular cannot occur without changing the original curve or bend, and this is the true reason why it tends to straighten it.

I wish to correct a popular fallacy that a curved tube, if of circular cross section, has any tendency even to straighten itself out by any internal pressure.

A. F. NAGLE.

Professor Tyndall an Engineer.

At a recent meeting of an English technical institution, Professor Tyndall made his own early experiences the subject of an address. From his interesting speech we learn that he commenced his active life by working as an assistant engineer on an Ordnance Survey that was made of the British Isles by the government. He quitted that service in 1843, just as the railway mania was approaching, and the knowledge gained on the Ordnance Survey enabled Tyndall to find employment in surveying railways. He mixed in the thick of the fray connected with the pushing of new railway lines. It was a time of terrible toil. The day's work in the field usually began and ended with the day's light, while frequently in the office, and more especially as the awful 30th of November—the latest date at which plans and sections of projected lines could be deposited at the Board of Trade—drew near, there was little difference between day and night, every hour of the twenty-four being absorbed in the work of preparation. Strong men were broken down by the strain and labor of that arduous time. Many pushed through, and are still among us in robust vigor, but some collapsed, while others retired with large fortunes.

While in the Ordnance Survey Tyndall's pay never reached five dollars a week, yet he has often wondered since at the amount of genuine happiness which a young fellow of regular habits, not caring for pipe or cup, may extract even from pay like that. These simple habits enabled him to save money from the pay he received on railway work, and when the rush of this business was over he retired from the field worth some fifteen hundred dollars. This money enabled him to carry a fondly cherished scheme into execution. Reading Carlyle and Emerson and Fichte had inspired the young engineer with the ambition to study science and philosophy in a German university, and in company with Frankland he entered the university of Marburg. He entered with zeal into the studies, inspired to work by the philosophical teaching of loyalty to duty. How faithfully he did his work under this impetus the high success of his life bears the best testimony.

The Machinery of Election.

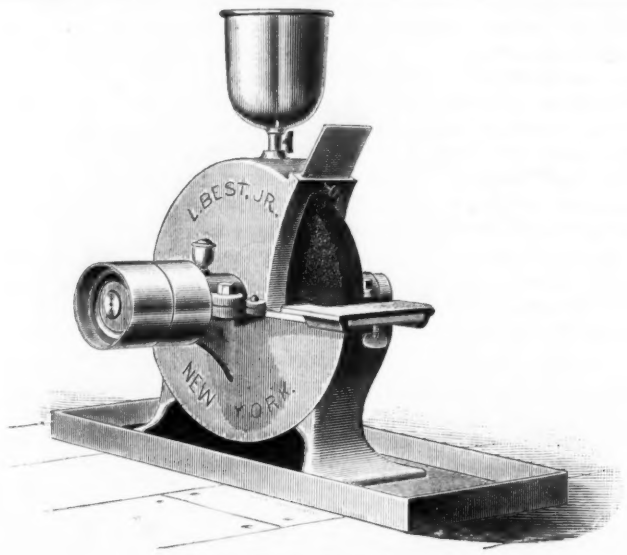
Machinery is useful in almost every kind of business, and why should it not be utilized in conducting elections? This idea seems to have been favorably received in Massachusetts. The Springfield *Republican* says:

"The trouble with the new-fangled ballot-boxes was mostly the fault of the voter. The old habit of crumpling a ballot in the hand, in order to conceal its proclivity, makes it impossible for the rollers to catch the paper when the crank is turned. In this way, in Precinct D, the crank was turned eighteen times during the day when the ballots refused to be drawn into the box. Of course, the registering dial showed eighteen more ballots cast than were found in the box. In Precinct I a key was broken in the lock, and the machine couldn't be used till a locksmith had opened it."

The Little Giant Tool Grinder.

The use of corundum or emery wheels in place of grindstones for grinding tools is the practice in many machine shops. The tool grinder illustrated in the engraving, made by L. Best, Jr., 36 John Street, New York, is a very convenient one for this purpose. It carries a 10-inch wheel, which runs in water to prevent the danger of drawing the temper of tools in grinding. The wheel used is a special corundum wheel, the particular quality of which has been determined by extended experiment.

The grinder occupies but little space, and can be set on a bench or in any convenient place, thus in a large shop permitting the locating of several, to avoid traveling long distances to the grindstone. It is so covered as to make it clean, and its operation causes no offensive smell.



LITTLE GIANT TOOL GRINDER.

A New Method of Constructing Horizontal Tubular Boilers.

BY FREDERICK A. SCHEFFLER, ERIE, PA.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Since the early history of steam boilers, science, in its progress toward a more efficient and, at the same time, a more simply constructed boiler, has been constantly nearing the perfection looked and hoped for, by the many changes for the better which have been made in the rolling of boiler plates, of either iron or steel. It is true that improvements have been made more rapidly in the manufacture of steel plates for boilers than in iron plates, due chiefly to the fact that the steel plates have no grain to be considered in rolling them either lengthways or crossways for their use in boilers, whereas, with iron, the peculiarity of its fibrous structure is an objection to the manufacture of large plates.

Were it not for the superiority (as the writer firmly believes) of steel over iron for use in boilers of all sizes, and the fact that plates from the smallest dimensions to the enormous size of sixteen feet long and one hundred inches wide can be obtained, there could be no possibility of a paper at this time on this subject.

When steel can be obtained, for use in boilers, having a guaranteed tensile strength of 60,000 lbs. per square inch, an elastic limit of 30,000 lbs., an elongation of 20 per cent. in an 8 inch specimen, and a reduction of area from 45 to 50 per cent., and which will also bend down close when cold, without fracture, it is very apparent that the superiority of steel over iron cannot be questioned. Another favorable point is, that this quality of steel is homogeneous and it will not blister.

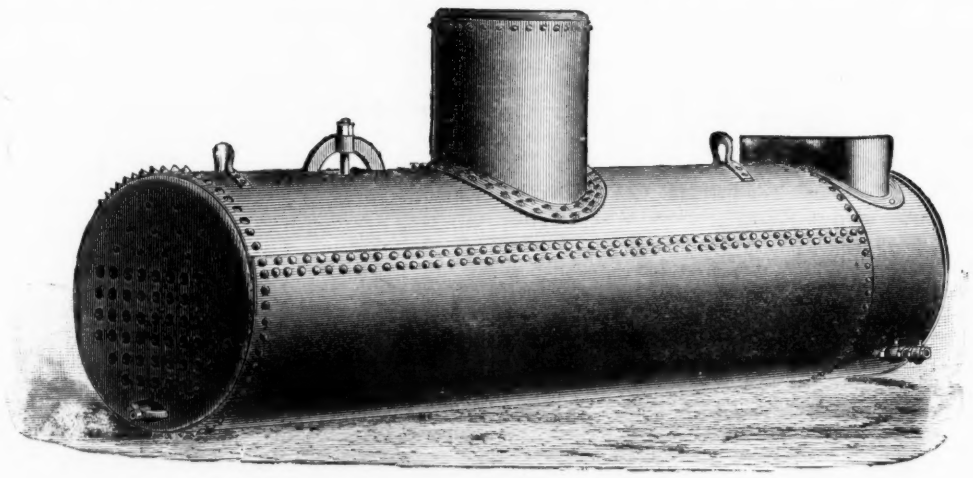
The fact that these large plates of steel can be obtained, caused this question to arise in the mind of the president of the works where the writer is employed: Why not construct boilers of steel in two plates only? The advantages are numerous and of the best kind.

It is well known that attempts have been made, and these attempts have sometimes been successful, to make a boiler of the style in question with a single plate on the bottom, by hammering and swaging into shape. No reliability can be placed on boilers made by this method, as the iron (when iron is used) loses its toughness and good qualities by being subjected to such a large amount of hammering as must be done to form such a construction. Mr. D. K. Clark refers to some tests which he made on welded iron plates, and although some of the tests were very satisfactory, yet the danger lest it be not known *positively* whether the weld would be a substantial one or not, causes reluctance in recommending boilers with welded plates. This method is also very costly, and with the uncertainty and cost combined taken into consideration, this method has been abandoned.

By making a boiler, as shown in cut, entirely of two plates only (except, of course, the flue sheets), the following advantages are apparent:

I. By carrying the longitudinal seams above the water line (say two inches above the top of the flues) and closing up the brick setting at that height, there will be no seam exposed to the fire other than the lower half of the back head. This is a positive advantage over boilers as commonly constructed, when there are from four to eight seams exposed to the fire.

II. By thus eliminating the exposure of the seams, a greater reduction is apparent of the chances for a leakage around the rivets.



NEW STYLE OF HORIZONTAL TUBULAR BOILER.

III. The advantage of equal expansion and contraction is so great as to also be of great benefit, and the usual excessive strains are largely reduced.

IV. For cleaning the boiler, no question can be raised as to the benefit of a single plate on the bottom. There are no rivets for lodgment of scale, sediment, etc., and there are no seams to interfere with a thorough scraping of the shell.

V. There being no seams vertically, the boiler must be stronger, as there are no holes punched for rivets.

This latter fact is the one, I apprehend, that will give rise to the most serious discussion of this paper. I am inclined to think some member will question whether one large plate extending the whole length of the boiler will be as strong as the same plate, cut into two or three pieces and then single-riveted together. I believe that the former is the stronger of the two, and if the boiler is properly supported (as all boilers should be) there will not be any trouble with the boiler springing or the plates warping.

A set of hollow rolls 16′ 4″ long, in the clear, and each roll 14″ diameter, and $2\frac{5}{8}$″ thick, was designed some time last spring by the former superintendent. When the writer took charge, it was proposed pushing the matter forward as soon as possible, and patterns were made immediately and then put in the hands of the moulders.

The castings were soon under way, and by the first of September the rolls were ready for the first experiment. They were geared to run by belting from the main line running 120 r. p. m., and the speed reduced to 3 r. p. m., on the rolls. Eight-inch single belting was used. The first sheet experimented with was for a 36″×10 foot boiler and the plate was 62″ wide and 10 feet long, by $\frac{7}{32}$″ thick, of steel. The rolls worked somewhat hard at first, being new, and they were allowed to run two days to stretch the belting as much as possible. The stretch was then taken up and the plate entered into the rolls. This plate went through in good shape and so did the top plate—the latter rolling up easier than the bottom plate, because the sheet had been punched for the dome and a hole cut for the manhole. A larger plate was tried next—a plate 12 feet long $\frac{9}{32}$″ thick—when it was found that the gearing was insufficient for the work. An alteration was then made, new gears being substituted by which the power was largely increased and 10″ belts were used. The 12 foot plate was then rolled. The amount of power required to roll this immense sheet of steel was entirely beyond expectation. When a 12 foot plate $\frac{5}{16}$″ thick was attempted it was rolled entirely by "coaxing," as the belts would slip, although the pulleys were quite large in diameter and as wide as convenience would permit. The pressure exerted on each roll at its circumference, or at the pitch line of the gears on the rolls (the latter being the same diameter as the gears), is estimated to have been 15,000 lbs., and was supposed to have been sufficient to roll a plate of any size the rolls would take in.

The idea of belting was at once abandoned and an engine was specially constructed to gear direct.

On the 23d of September, 1884, the first 60 inch boiler, 16 feet long, $\frac{3}{8}$″ thick of steel, was constructed in two plates. This is the *first* boiler of this description ever made in this country, and as far as the writer has knowledge in any other country. It is found that a greater degree of accuracy can be maintained in getting the rivet holes in direct line, and thereby the likelihood is greatly reduced that the boiler-makers will have the chance to use the detestable drift-pin, that greatest of all evils in boiler construction.

Some members may have their objections to the use of steel for boilers, and claim that it is so recent in the market that the method of handling it in manufacturing establishments is not yet sufficiently well developed to be relied upon. The writer heard of a gentleman, a short time ago, who objected to the use of steel for boilers for the above reason. The manufacturers who make a specialty of using this material, of course have the advantage over those who use it only on occasional orders; but I do not hesitate to say that, since this material has been in use for upwards of eight years, there has been every opportunity that could be desired for all interested to avail themselves of the proper knowledge of the handling of it.

If locomotive boilers constructed of steel should be made with only one course in two plates, from the throat sheet to the smoke-box, there would undoubtedly be a great reduction of the liability to leakage and wear and tear, and probably a longer life of the boiler would be secured, although the fire-box is generally the first place to need repairs.

It is the writer's belief that this new construction of horizontal tubular boilers will be the method of the future for this type, and he hopes that the few points brought forth in this paper will be of service in stimulating discussion and further progress in this direction.

Glasgow Authorities Providing Work for the Unemployed.

The London *Ironmonger*, of November 1, says:

"The tone of feeling in the various mercantile centers in Scotland is decidedly more hopeful this week, as a consequence mainly of reports—to a large extent confirmed—of good contracts being placed in the iron-foundry trades. There is a great amount of distress, however, among the working classes, many of whom have been out of employment for nearly twelve months. In Glasgow the magistrates and Town Council are providing employment for those who can avail themselves of it in the construction of works, the execution of which has been hastened for the purpose."

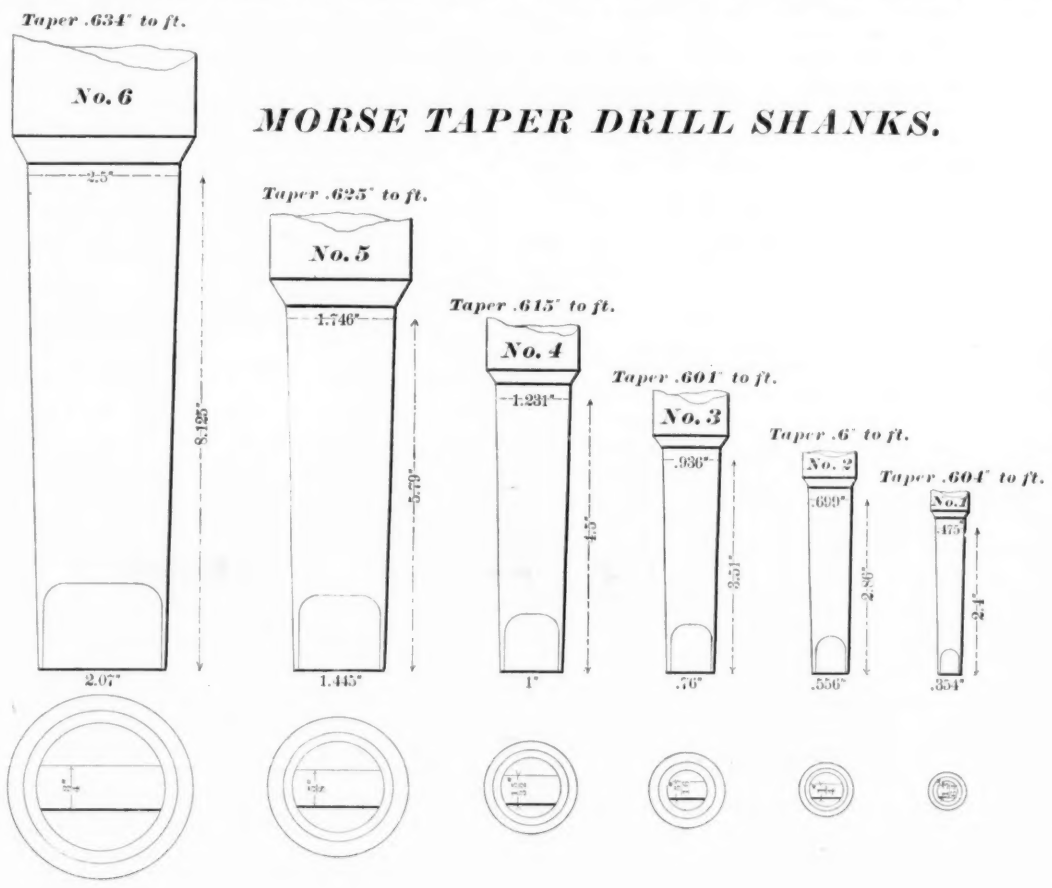
The Largest Vacuum Pan in the World.

At the Deeley Iron Works, in 32d Street, New York, machinists are erecting the largest vacuum pan that ever has been made. The pan is a pear-shaped vessel made from sections of cast iron whose edges are planed and bolted together. It is 17 feet diameter inside, and the whole vessel, when put together, attains a height over 40 feet, and will weigh 140 tons when empty. The pan is being made for the California Sugar Refining Company of San Francisco, and has sufficient capacity to boil 100 tons of sugar at once. To supply heat to boil this immense mass of sugar the pan contains 69 coils of 4 inch copper pipe arranged in the form of a hollow inverted cone providing 3000 square feet of heating surface. To carry off the steam as it rises, four openings, 10 inches diameter, are provided for connecting with the vacuum pumps, and a constant stream of water that fills a 10-inch opening is needed to absorb the heat of evaporation. The whole structure is being erected in the Deeley Iron Works for the purpose of ascertaining that every part is the proper size and all the fittings correct. After this is done it will be taken apart and shipped to California.

A dispatch from London says: The tin and copper mining industry in the west of England feels encouraged on account of the belief that the newly-elected Congress in the United States will take measures to remove the existing duties on metal imports. Probably this belief is unfounded.

The Morse Taper.

The question as to the taper of the shanks of the Morse twist drills—the "Morse taper," as it is generally called—is frequently raised, and is very seldom correctly answered. With a view to obtaining exact information on the subject, we wrote the Morse Twist Drill and Machine Company, who courteously sent us drawings, from which the accompanying engravings, reduced to one-third scale, were made. It will be seen that there are six sizes, and as many distinct tapers. The figured dimensions give all the information that is required.



Fifth Annual Meeting of the American Society of Mechanical Engineers.

The fifth annual meeting of the American Society of Mechanical Engineers was one of the most successful and interesting yet held. The president's address was an attractive talk on mechanical subjects, and made a pleasant introduction on the first evening. The election of Mr. J. F. Holloway, of Cleveland, to the position of president, honors a popular and highly representative mechanical engineer. The society had to make an important change in its permanent officers by the resignation of the treasurer, Mr. Charles W. Copeland, who deserves the credit freely accorded to him by the members of having placed the society upon a sound financial basis. Electing Mr. Copeland one of the vice-presidents was putting into that position a veteran mechanical engineer of national repute. While losing the valuable services of Mr. Copeland as treasurer, we are assured that the business will be properly managed by the new incumbent, William H. Wiley. During the first evening of the meeting the venerable Horatio Allen, honorary member, occupied a seat beside the president, and it is a matter for regret that he was not induced to favor the meeting with a few words on his long-ago engineering experiences.

The papers on the docket were rather too numerous for the time available for their discussion, but they were nearly all unusually interesting, and the attention of the members was well maintained up to the finish. From the extracts read by Mr. Kent from the "Code of Rules for Conducting Boiler Tests," prepared by the committee appointed at Pittsburgh, we believe, when the code is finally formulated, that it will prove of great service to the mechanical world, and be a credit to the association that produced it. The paper read by W. F. Durfee, giving "An Account of the experimental Steel Works at Wyandotte, Michigan," was a valuable contribution to the metallurgical history of the United States. Memories are still fresh regarding the events connected with the struggle carried on during the first attempts to make Bessemer steel in America, and now is the time to put the particulars on record. Men connected with important new industrial enterprises are generally so much engaged with their own immediate business, that they have no leisure to make what are really momentous contributions to current history, and in too many cases the principal actors drop off without giving information that the whole world would value. The paper read by R. W. Hunt on the "Original Bessemer Steel Plant at Troy" was another interesting chapter in our metallurgical history, and as such was accepted by the members. "Locks and their Failings," by A. C. Hobbs, was a narrative of most entertaining personal reminiscences, illustrated by numerous drawings of ancient, curious, complex, simple, and modern locks. Our limited space forbids us from following out the papers, outlining their character, and this is hardly necessary, for most of the papers will be published in these pages at length or by abstract.

Animated discussions were provoked by most of the papers, and in some cases valuable information was elicited. During the discussion of the papers on "Friction," Dr. Irvine, analyst for the Standard Oil Company, gave many interesting facts regarding the behavior of lubricants under different circumstances. The debate which Mr. Oberlin Smith caused by proposing to investigate Patent Office affairs was also well worthy of the time devoted to it, and demonstrated how strongly the individual members feel about the picayune way the United States Government runs the Patent Office. The rapid growth of the organization, combined with the active interest manifested by the members in the meetings, promises within a few years to make the American Society of Mechanical Engineers as prosperous and useful as any association in the country.

After the preliminary business was transacted on the second day of the meeting, Mr. Oberlin Smith directed attention to the unsatisfactory condition of business in the Patent Office, and expressed the belief that it was the duty of the society to use their influence for securing reforms. It is not for want of the means necessary to carry on the Patent Office work efficiently that the trouble arises, for there is plenty of money in the treasury, but it is not used for the purpose it was collected for. He recommended that a committee be appointed to deal with the subject.

Mr. Edson thought the society should not be too precipitate in recommending changes in the Patent Office, or in doing anything that might interfere with the efficiency of the patent laws as they exist. There is a strong tendency in Congress to change existing laws to the disadvantage of inventors, and it was not desirable to give any excuse for moving in that direction. He thought the reforms needed in the Patent Office were principally the better remuneration of employes, so that men who had worked into the technicalities of the business should not find that it paid them better to quit the Government service and open offices as patent solicitors.

Mr. Town thought the dangers of the patent laws being changed was no reason why the society should not take an aggressive stand in demanding reform in the Patent Office. Three millions of dollars have been taken from inventors without any return, and he insisted that the money should be devoted to facilitating the business of the office that controlled the issue of patents.

Mr. Partridge thought that if we were going to stir this patent pool it should be done with a very long stick. The waters were very unsavory under the surface, as he could testify from personal experience.

Motions were then carried requiring the appointment of a special committee to report on the subject. The recommendations of this committee will be given elsewhere.

Mr. Kent read portions of the "Code of Rules for Conducting Boiler Tests" prepared by a committee investigating the subject.

The paper read by Mr. W. F. Durfee on "The Experimental Steel Works at Wyandotte," and that read by Mr. R. W. Hunt on "The Original Bessemer Steel Plant at Troy," were discussed together.

Mr. Holloway was very much interested in these papers giving the early history of Bessemer steel-making. It is right that a record of the early struggles in this work should be preserved by those who took part in them. He well remembered the opposition to the new process by the old blast furnace men. It was the wonder of the world to such men how so much money should be put into an apparatus. There was an old furnace man in his vicinity who was a public authority on metallurgical matters, and this Vulcan violently insisted to all and sundry that the costly apparatus was a useless waste of money. He could demonstrate that molten metal could be oxydized in an ordinary furnace ladle. To do so, he poured in the metal, stuck a big potato on the end of a long pole, and pushed it into the molten mass, when it resulted in what he afterwards described as a "hell of a bubble."

Mr. Stirling had been an assistant to Mr. Holley in the Troy works, and he testified to the discouraging opposition encountered by the new steel process. He gave particulars of early experiments with converters and cupolas made by Mr. Holley, and spoke of the very pleasant relations that ever existed between Mr. Holley and his assistants.

Mr. Barnes was also an assistant to Mr. Holley during the genesis of the Bessemer steel process, and he also expressed admiration for that great engineer. Although American steel-makers had nominally followed European practice, they had practically struck out new paths for themselves. He was employed making tracings for Holley of English drawings of Bessemer plant, and it was surprising how few of the ideas were adopted.

No discussion followed the amusing talk from Mr. Hobbs on "Locks and their Failings."

The secretary read an abstract of Mr. Scheffler's paper on a "New Method of Constructing a Horizontal Tubular Boiler."

Mr. Stirling did not think the horizontal tubular boiler has made much progress. It is in about the same condition now as it was when he was a boy. Engineers prefer it because it has a large capacity for carrying water. The want of this capacity he considered to be the drawback of the sectional boiler. The locomotive engineers are striving towards higher pressures. Water tube boilers are not used in steamships, and but little for power purposes. Why was this the case?

Mr. Emery thought the scope of this discussion might easily be enlarged. In the use of steel for naval purposes, intense care had been exercised to reject sheets that were not up to the high standard required; consequently, a great deal of inferior steel had been rejected. He warned boiler-makers against the inferior grades of steel sheets that are in many cases offered. He protested against the hard usage steel plates were often subjected to by workmen in some constructive operations.

Mr. Stratton wished to inform the meeting that in the French navy there are three sets of water tube boilers that are giving entire satisfaction. They do their work as well as the Scotch boiler, without having its dangers, and they give a greater supply of steam, with considerably smaller percentage of weight. Our own Government is now seriously considering the desirability of trying water tube boilers in the American navy.

A desultory discussion on the construction of boilers now intervened, in which no special point was made.

Mr. Davis objected to some forms of tubular boilers that require brick setting. Where they use water containing acid in boilers, the corrosion that ensues is not on the seams, but on the body of the sheets next to it. They had no trouble with boilers giving out at the seams. He had a case of a nearly new locomotive boiler blowing up from over-pressure; it was a bad explosion, yet very few of the rivets gave way. The boiler was iron, and the bursting pressure must have been considerably over two hundred pounds.

Mr. Porter had seen in Europe, several years ago, some boilers with welded seams. He wanted to know why that construction had not become popular.

Mr. Barnes answered that a safer seam could be made by riveting than by welding. However well managed a weld might be, its strength in relation to the sheet was an unknown quantity.

The *Railway Review*, of Chicago, has reprinted in pamphlet form, most of the articles it has published during this year on important railroad subjects by leading railroad authorities. Among the pamphlets on our desk are "Efficient Railroad Management," by H. S. Haines, general manager Savannah, Florida & Western Railroad, and "The Necessity for a Classification of Freight," by Edward P. Vining. Both these subjects are treated in a masterly manner, and the publications will supply valuable counsel to many railroad men.

A recent article in *Invention*, a London paper, discusses safety arrangements for factories. It says: "We have personally visited many factories, large and small, and can ourselves testify to the fact that even now a large amount of very dangerous machinery is either quite unprotected or fenced in a very imperfect manner. In one instance—and that, too, in the heart of London—we saw the end of a small shaft revolving at a high speed allowed to project some inches through a partition only three feet from the ground, and in a very narrow passage continually traversed by the work people. 'Orders' had been given, we were told on pointing out the great and constant peril, to have the machinery stopped and the projecting end of the shaft cut off; but we believe the 'orders' were of very ancient standing. We truly trust that they have been now carried into execution."

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NEW YORK, NOVEMBER 29, 1884.

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British Government Telegraphs.

In a recently published report United States Consul Lathrop, of Bristol, England, gives interesting particulars respecting the Government telegraph system of Great Britain. The telegraph system in Great Britain originated in the year 1846, and it grew up by degrees through the labors of private companies, much in the same way as the telegraph system has developed in this country.

The various companies served the public very fairly, yet a sentiment arose that the work of transmitting telegraph messages had a close relation to post-office business, and that consequently the telegraph system ought to be put under Government control, and operated as a part of the postal establishments. By degrees this sentiment grew so strong that in 1868 an act of Parliament was passed to enable Her Majesty's Postmaster-General to acquire, work and maintain electric telegraphs. The bill provided that the Government should acquire its telegraphic system by purchasing the lines owned by the various private companies then existing. The terms of the bill were permissive, and no company was compelled to sell out against its will. At first the Government merely entered the field to compete with companies that might not be ready to sell their lines, but the companies, seeing that they could not compete successfully against the Government, and the terms of purchase being favorable, so far relinquished their property that at the end of a year Parliament passed a second act giving the Government the exclusive privilege of transmitting the telegrams. This did not interfere with the private telegraph business of railways.

Before the Government assumed control of the telegraph system, there was an active minority of the people strongly opposed to the scheme, but a short experience of the improved service effected by the Government abrogated all opposition. Under private companies senders of messages were charged twenty-four cents for twenty words or less for 100 miles or under, thirty-six cents from 100 to 200 miles, and forty-eight cents for distances over 200 miles. Under the Government system a uniform charge of twenty-four cents for the first twenty words, not counting names and addresses, was introduced for the whole United Kingdom, and twelve cents for each additional ten words. This charge includes the cost of delivery by special messenger within one mile of the terminal office, or within the limit of its postal delivery, if a head office, and that distance exceeds a mile. If the distance is outside the postal limits, and beyond a mile from the office, a charge of twelve cents per mile is made for a foot messenger. All payments are made in postage stamps, except that of the messenger, and a message may be stamped and dropped into any letter-box where it will be collected and sent off without more attention from the sender. The number of messages sent increased very rapidly under this improved system. In 1871 one-third of a telegram was transmitted for each inhabitant of the United Kingdom, while in 1883 the proportion had increased to eight-ninths of one for each inhabitant. To meet the increased business that resulted from lower rates and better facilities, the telegraph offices were more than doubled during the Government control, and since then offices have been established promptly in new localities so soon as business seemed to require that accommodation.

The terms of purchase offered to the private telegraph companies by the Government were: Twenty years' purchase of the net profits during the year ending June 30, 1868, also a sum equal to the estimated aggregate value of the quoted ordinary share capital of the company reckoned at the highest quotation shown in the official lists of the London Stock Exchange on any day between the 1st and the 25th of June, 1868; also compensation for the loss of the prospective profits of the company on the ordinary shares. By these terms the Government paid to eight companies a little over $32,000,000, for which they obtained possession of 77,000 miles of wire, fully and completely equipped with the best appliances then known.

Although the price paid for the telegraph system was high, the establishment was self-supporting from the start, and the service rendered was cheaper and more efficient than anything of the kind done under private ownership. It has never even been suspected that the telegraphs are ever used for political purposes, and people have perfect confidence in the close way that secrets entrusted for transmission are guarded. After expatiating at considerable length on the advantages the British public derive from Government control of the telegraphs, Mr. Lathrop concludes:

"We turn now to the United States. The greater the distances the greater the use of the telegraph; the fewer the other means of communication the greater and more constant the employment of the wires. Under these two principles we should expect to find there a far more general use of the telegraph than in the United Kingdom, but instead of this we find, in 1881, a difference of only 3,000,000 in the number of messages, with a difference in population of 20,000,000, and an incalculably greater field with conditions far more favorable. And why is the telegraph not more used in the United States? Clearly because facilities are lacking and rates are high. And clearly they are as they are, because income has been used for dividends on unduly swelled capital rather than for building lines, opening offices and reducing rates. And clearly the only remedy is in Government control. I say nothing as to the means by which this should be accomplished, that being a question under discussion in Congress; but as to the main question, it seems to me that the advantages, especially in America, of State proprietorship of the telegraphs are so obvious as only to require to be brought to the notice of the people in order to make them a unit in demanding the immediate application of the principle to the United States."

A Texas Editor on the Tariff.

The editor of the Fort Worth (Tex.) *Weekly Gazette* has concluded that "protection must go," and says: "The only question will be, shall the agricultural interest pay hundreds of millions of dollars to sustain protection, or let the manufacturers shift for themselves in a fair field and no favors?"

We do not agree with this Texas editor, and we do not think the American people agree with him.

Let it be considered, first, that the Government requires a large revenue, and must always so require. Then, this being the case, the question arises, is it not better for the people of Texas, as well as of every other State, that this necessary revenue should be raised in a manner that will benefit American industries, rather than in a manner that will benefit nobody but foreign exporters?

Is it not better for the people of Texas and every other State, to have large manufacturing communities on American soil, consuming Texas beef, mutton, and cotton, than to build up similar communities in England, consuming Australian beef and mutton, or African cotton?

We may further differ from the editor of the *Gazette* as to the exact method of constituting this kind of a protective tariff, but why should there be any difference as to the essential idea involved?

Machinery of the Steamer Umbria.

A representative of the AMERICAN MACHINIST enjoyed the privilege of examining the machinery and boilers of the fine new steamer Umbria, belonging to the Cunard line, while the vessel was lying at the company's wharf in this city. The main engines are the leading attraction to the numerous mechanical visitors anxious to look around the ship, yet in appearance there is nothing specially different about them from the engines of the Oregon, or any other vessel having the best kind of vertical inverted compound engines. These are notable owing to the cylinder capacity, having one high-pressure cylinder 71 inches diameter, and two low-pressure cylinders each 105 inches diameter, the stroke being 72 inches. All the latest aids to handling marine engines are attached to these, so that, in spite of the enormous weight of the working parts, the machinery is handled as easily as a good working lathe. The circulating pumps are of the centrifugal type, and are separate from the main engines, two high-speed engines attached to the pumps direct supplying the power.

On the second deck an apartment adjoining the main engine room is fitted up with the electrical machinery that supplies the ship with light. There are four Brotherhood engines coupled direct to Siemens dynamos, and run at a speed of about 600 revolutions per minute. This plan of entirely dispensing with the use of belts is found very serviceable on shipboard.

There are nine boilers of the ordinary Scotch type, double-ended, with four Fox patent corrugated furnaces at each end, and they carry 120 pounds' pressure of steam per square inch. The boilers are arranged fore and aft, three abreast, making four separate stroke holes, two of them having 12 and two 24 fires each.

We learned that during the trip across the engines indicated 13,000 horse-power, but at what expenditure of coal this work was done no reliable information could be obtained.

All work that has to be done on deck in the way of handling cargo or in working the ship, is facilitated by steam engines arranged at convenient points from stem to stern. Highly efficient means are provided for applying steam to the launching of the 12 lifeboats carried by the ship. The steering gear is also operated by steam, which is supplemented by hand gear for use in emergencies.

The article by J. C. Hoadley on "Balancing the Running Parts of Steam Engines," which we publish on page 4 this week, is well worth a careful reading and preservation. The subject is treated by that well-known engineer in a manner intelligible to those who have no knowledge of higher mathematics.

Leander Garey, superintendent of the car department of the New York Central Railroad, has resigned, and intends to go abroad for a year. Mr. Buchanan will take charge of the entire rolling stock belonging to the company.

Mr. J. A. Durgin, the well known locomotive builder, met with an accident at Providence, R. I., recently, from the effects of which he died within a few hours. Most mechanical men will remember Mr. Durgin as successively superintendent of the Pittsburgh Locomotive Works of the Rhode Island Locomotive Works, and general manager of the New York Locomotive Works. A few weeks ago he was appointed superintendent of motive power of the New York, Providence and Boston Railroad. While attending to the duties of this position he was caught between two cars and fatally injured.

Literary Notes.

TREATISE OF VALVE-GEARS, with Special Consideration of the Link-Motion of Locomotive Engines. By Dr. Gustav Zeuner, Professor of Applied Mechanics at the Confederated Polytechnikum of Zurich. Translated from the fourth German edition. By Professor J. F. Klein, Lehigh University, Bethlehem, Pa. E. & F. N. Spon, 16 Charing Cross, London, and 35 Murray Street, New York.

With those acquainted with the use of mathematical formulas, the works of Zeuner on valve-gears will always be popular. In the present edition the author has entirely re-written the part treating of valve-gears with independent cut-off, making it very comprehensive. The edition is well printed and illustrated, and is a standard work on the subject.

THE YOUNG ENGINEER'S OWN BOOK. Containing an explanation of the Principles and Theories on which the Steam Engine as a prime mover

is based, with a description of different kinds of steam engines, condensing and noncondensing, Marine, Stationary, Locomotive, Fire, Traction, and Portable; together with instructions how to design, proportion, locate, repair, reverse, and run all classes of steam engines. With tables and formulas for finding horse power. Also suggestions on the selection, care, and management of all classes of steam engines, boilers, pumps, injectors, etc. For the use of educational institutions, where students are intended to engage in mechanical pursuits, and for the private instruction of youths who show an inclination for steam engineering. With 106 illustrations. By Stephen Roper, engineer. Philadelphia, Edward Meeks, 1002 Walnut street.

The author is well known in connection with a series of books on subjects analogous to this one. We do not believe his reputation as an author will be strengthened by the present effort. While the book contains information that will be found of value to young engineers, there is so much of inaccuracy about it as to detract seriously from whatever of value it would otherwise possess. As random instances, the reader is told, in "How to set a slide valve," that, "if the lead is not equal at both ends it may be equalized by moving the eccentric slightly back and forth." Re-evaporation, in the cylinder of a steam engine, it is said, "means the conversion of water into steam by compression." Force is defined as "the change of motion in material bodies;" and to the question "What is gravity?" the answer is: "Gravity denotes the *mental* tendency which all bodies in nature have to approach each other."

As indicating the author's idea of refinement required in the parts of a steam engine, he says, that the deviation of the crank-pin from the line of the shaft of "even the one-hundredth part of an inch would affect the working."

Speaking of the link, he says, whatever he may mean, that: "except when employed as a cut-off, and the lap and lead is increased simultaneously, the link would be a perfect expansion gear;" and when it is in mid-gear "neither admission nor release can occur." Also, "when the link is used as a valve gear, any increase of *lap* increases the *lead* also."

In the "Proportions of steam engines," we read that the depth of the boss of crank "should equal the diameter of the shaft journal multiplied by 7," and that the "diameter of piston-rod should be .25 the diameter of cylinder," this is also the diameter recommended for steam pipe.

These are only samples of mistakes and inaccuracies that are so common as to create astonishment that the publishers had not noticed them.

The Pennsylvania law prohibiting the truck pay system has been tested in the local courts, and carried up to the county court. In both cases the decision sustained the validity of the law. It has been appealed to the Supreme Court, where a final decision will be rendered. The truck pay system is a cancer upon our industrial institutions, and the spectacle of large manufacturing companies fighting against the law enacted to remove it is anything but pleasing.

Wayland Turner, agent for the Joy Valve Gear, writes us at some length claiming that Joy used the same "sword-arm rig" some years ago, that was mentioned in a recent letter by Geo. S. Strong. We have no room for a discussion of the comparative claims of Joy and Strong as to invention of devices used in valve gears.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(455) J. V. B., New York City, asks: Suppose I have a chain connected between two spiral springs, in such a way that the pull of each spring, in opposite directions, is 3000 lbs., what will be the strain on the chain? *A.*—3000 lbs.

(456) B. Phenix, R. I., asks: What per cent. duty is there on imported machinery. *A.*—45.

(457) C. L. B., Crested Butte, Col., asks: Will a locomotive run faster when hooked up so as to cut off steam, than when steam is admitted throughout the stroke, and why? *A.*—With a light load a locomotive will run fastest when hooked up. The cause is explained in the AMERICAN MACHINIST, No. 47, page 3, of this year. 2. Is there more back pressure in the latter case than in the former? *A.*—Yes.

(458) C. M. W., New York, asks: Is this rule for finding the strain per square inch of section to which boiler plate is subjected correct?—Multiply the length of plate required to make one inch in thickness by the pressure in pounds per square inch; multiply this product by the diameter of the boiler in inches and divide this product by 2. That is, if the plate is ¼″ thick it will take 4″ in length to make one inch in thickness, or if ⅛″ thick 2″, etc. *A.*—The rule is correct.

(459) J. L. L., Waterbury, Conn., asks: 1. At what angle should I grind knives for cutting iron 16 to 20 gauge so as to leave edges square as possible? *A.*—You will have to determine to a certain extent by experiment. We should say an angle of 8° would be about right; perhaps even less than that would be better. 2. I have a casting 2″x6′x16″. It is not strong enough, and I cannot make it heavier. Will casting a piece of steel 2″ x ⅝″ in the center strengthed it? *A.*—We doubt the success of this plan. If the shape is such that the piece cannot be made of wrought iron or steel we should recommend that you have a steel casting made.

(460) W. H. S., Kittanning, Pa., asks: 1. What constitutes the difference between a fast and slow locomotive valve motion? *A.*—The usual difference is, that in the valve motion of a fast locomotive the valve has more outside lap and greater travel than that of a slow engine. The slow engine generally has some inside lap of valves, which is not used with fast engines. 2. Is it always customary in a link motion to so place the hanger-stud, in the half-stroke cut-off position of the link, that it will vibrate in an arc parallel to central line of motion? *A.*—Yes. 3. In the Porter-Allen engine, what is the relative position of the eccentric and crank? *A.*—The position of the crank and eccentric are identical.

(461) A. F. W., Providence, R. I., writes: 1. I have a rule for finding the diameter of a pump when the number of gallons of water per minute are known, and the piston speed is 100 feet per minute. It is: Divide the number of gallons required per minute by 4, extract the square root of the quotient thus obtained, which will be the diameter of pump in inches. Is this right, and does it refer to a single or double-acting pump? *A.*—It refers to a double-acting pump. The pump should be at least 15 per cent. larger than indicated by the rule to provide for loss of action. 2. Is this rule correct for determining the size of air pump? *A.*—No. An air pump must be much larger than would be sufficient to take care of the water.

(462) Reader, Abilene, Kansas, writes: 1. A boiler 60″ diameter is made of 5-16″ steel plates. There is one row of rivets, in a length of 4½ feet, and another row of 13 in the same length. Would this boiler be safe at 100 lbs. working pressure? *A.*—We do not quite understand, from your description, whether the boiler should be considered as single or double riveted. If single riveted, according to U. S. inspection laws, if the tensile strength of the plate is 60,000 lbs., a working pressure of 104 lbs. would be allowed; if double riveted, 125 lbs. 2. There is on one of the sheets a spot ½″x¾″ that is only about one-half the thickness. Is this dangerous? *A.*—We cannot say. The probability is that it is not. If it does not extend further than you say, it can be drilled and plugged.

(463) A. F. A. M., Wilmington, Del., asks: 1. How is the length of a locomotive link determined? *A.*—When an engineer is designing a valve-motion, he settles the length of the link to make it harmonize with the other parts of the motion. 2. What are holes in stay bolts for? *A.*—To indicate by leaking when a stay bolt breaks. 3. Is there any advantage in having babbitt metal in locomotive rod brasses? *A.*—Brasses generally run and wear better when babbitted than when plain. 4. In your paper of Nov. 8, L. S. S. says he would shove his valve ahead in case of broken yoke as far as it would go. Would he not open the exhaust port on a good many engines by doing so? *A.*—In some cases he would; but that can be tested before the work of taking off the chest cover is begun.

(464) H. H., San Luis Obispo, Cal., asks: 1. Can you tell me a good way to temper a long tap or piece of steel to avoid springing? *A.*—Such tools spring from inequalities in the steel from being unevenly heated, and unequally cooled. We can only suggest that care should be taken in forging to subject all sides of the stock to equal hammering at the same heat; that in heating to temper great care be used to heat evenly, and that in cooling the same care be used. 2. If I can make a tool that will swage and weld tubes without taking them from the fire, at the rate of 100 per day, the tool being so simple that any blacksmith can make it, would it be of any value? *A.*—There are several machines in use for welding boiler tubes that work very satisfactorily. Still, if you have something quite simple, that will work as well as you say, it will undoubtedly have some value.

BUSINESS SPECIALS

Transient Advertisements, 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Curtis pressure regulator and st'm trap. Nov. 22, p.10.

Mackenzie Cupolas and Blowers, 245 Broadway, N.Y.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Figs per set $1.00. S. M. York, Cleveland, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Friction pulleys and couplings; cheapest and best H. N. Bates, 358 Atlantic avenue, Boston, Mass.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 632 F st., Washington, D. C.

Power Measured—F. Van Winkle, mechanical engineer, 22 Cortlandt street, New York.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

The Straight-Line Engine Company, Syracuse, N. Y., will send their new catalogue on application.

Split Pulleys at low prices, and of same strength and Appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Mech'l drawing and machine designing, work requiring skill and experience solicited. Reasonable rates. Corresp'nce invited. Weston & Smith, Syracuse, N.Y.

DRAWINGS—Mechanical, electrical and Patent Office. All styles of artistic designing. Special facilities. Low rates. Wallace Metcalf, 140 Nassau St., N.Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

MANUFACTURES.

C. J. Dixon, Pulaski, Tenn., will build a wagon factory.

H. T Beggs, Sr., Birmingham, Ala., will build a stove foundry.

The Low Moor Iron Company, Low Moor, Va., talk of building a new blast furnace.

Bovaird & Seyfang, Bradford, Pa., are just completing new blacksmith and boiler shops.

A new cotton-seed oil mill is to be built in Brooklyn, New York. Augustus Hatfield is the architect.

The Leslie Sewing Machine Company will soon begin the erection of a four story factory in Cleveland, O.

The Texarkana Foundry and Machine Works, capital $100,000, has been incorporated at Texarkana, Texas.

John F. Anderson, 302 Ewen St., Brooklyn, N. Y., will erect a 45x98 foot factory, four stories high, on Devoe St., to cost $8,000.

Another car shop is being erected at Port Huron, Mich., by the Grand Trunk Railway. It is to be used exclusively as a car shop.

The Rhode Island Locomotive Works, in Providence, have taken an order to build thirty light locomotives for the Brooklyn Elevated Road.

The Mecklenburg Iron Works, Charlotte, N. C., builders of steam engines and machinery, will erect an addition to their shops 270x40 feet, three stories high.

The Phœnix Furniture Company, of Grand Rapids, Michigan, is filling an order for furniture for a firm in London, Eng., the order amounting to about $100,000.

The machine shops of the Texas and St. Louis Railway Company are to be established at Pine Bluff, Ark. From 200 to 300 workmen will be employed in them.

On account of business depression the capital of the Bourne Mill, Fall River, Mass., has been reduced from $600,000 to $400,000. A new mill was built about a year and a-half ago to make fine Canton flannel.

President John Scott, of the Queen and Crescent route, is reported as promising to build the machine shops of that road at Chattanooga, Tenn, and says they will employ 2,000 men.

The firm of W. F. and John Barnes, of Rockford, Ill., has just been changed to a stock company under the title of the W. F. and John Barnes Company, with a capital of $150,000.

Some Northern capitalists are negotiating for land at Columbia, Tenn., on which to build a pump factory. W. C. Jones, Columbia, can give particulars.—*Baltimore Manufacturers' Record.*

The Whitman Agricultural Implement Works are being erected in Winthrop, Me. The machine and wood shop is 130x40 feet, two stories high, the foundry 50x40 feet, and the blacksmith shop 30x40 feet.

The employees of Benj. Atha & Company's steel works, at Newark, N. J., numbering 150, have been notified of a 10 per cent. reduction in wages. This is the second reduction of 10 per cent. within the year.

Knoxville Foundry and Machine Company, Knoxville, Tenn., manufacturers of steam engines, boilers, steam pumps, etc., have built a $3,000 addition this past season. They have also put in $6,000 worth of new machinery.

A Portland, Maine, Knitting Machine Company, which has been organized with a capital of $80,000, is seeking information about the Patten Car Works at Bath. The location of these works for manufacturing purposes is said to be excellent.

The Pennsylvania Steel Company, at Steelton, has issued orders prohibiting the employment of boys under 16 years of age. The intention is to induce parents to send their children to school. If all large manufacturing establishments would follow their example in this respect, a great industrial evil would be remedied.

The Cleveland City Forge and Iron Company are just completing certain additions to their buildings which increase the size of their works greatly. They have also added very largely to their plant of machinery lately, among the new tools being a 10-ton upright hammer, and a 56-inch stroke slotter, weighing 60 tons.

The S. C. Forsaith Machine Company, Manchester, N. H., are putting up for their own use at the New Orleans Exposition an iron building, 100x40 feet, in which they will put power and show some of their machinery in operation. They intend to take five of their steam engines, besides seventy-five other machines of different kinds, to the exhibit.

The *Cleveland Iron Trade Review* notes that Bowler & Company, of that city, have added to their railway supply manufacture, steel rail frogs, crossings, switches, switch stands, and track supplies in general. It says: "All their special tools are new and of the most approved kind. They work all the rails cold, thus preserving the normal condition of the steel."

Clem & Morse, Philadelphia, Pa., write us: We shall probably be in the market for some tools soon, as we have bought a large mill property fronting on Frankford Avenue, Wildey and Shackamaxon Streets, and expect to add a boring mill, shafting and pulley lathes, wood-working machinery, and possibly a new engine in place of the one now in. We shall have some upper stories to rent.

Isaac Burpee, E. R. Moore, and Charles E. Burpee, of St. John, E. R. Burpee, of Bangor, Me., and E. G. Scovil, of the parish of Simonds, have filed in the office of the Provincial Secretary of New Brunswick a memorandum of Association for the incorporation of a company, to be styled "The Coldbrook Iron and Steel Manufacturing Company." The object of the company is the manufacture and sale of iron and steel, castings and foundry work, with such other things as are incident to the attainment of that object, with a capital of $100,000, to be divided into 2,000 shares of $50 each. The office or principal place of business is to be at Coldbrook.

The Pratt & Whitney Company, Hartford, Conn have lately received strong testimony of the excellency of their die stocks from England. John H. Bishop of Cheltenham writes them: "I have had a set of your N. O. Patent Die Stocks (Grant's) in use for several years and can cheerfully testify to the durability and excellence of the same. But I often require to cut *finer threads* on the same diameters up to ¼ inch. The English screw plates are the only tools available for this purpose and they are valueless to me. I want results, not miserable substitutions. These wretched contrivances scratch or squeeze up a thread instead of cutting it. Your Grant's patent dies are the most perfect I ever saw and the results are splendid." Mr. Bishop makes an order for a lot of dies to cut fine threads.

The *Manufacturers' Gazette* says: "Considerable complaint is being heard at the excess of 'red tape' in the conduct of the affairs of the World's Fair at New Orleans. The Simmons Hardware Company, St. Louis, after urgent solicitation, agreed to transfer its magnificent exhibit at the St. Louis Exposition to New Orleans. The exhibit is a splendid creation, and has cost a great amount of labor and money. It contains some 7,000 different pieces, coming from all parts of the world. On making application for space at New Orleans it was informed that only builders and manufacturers themselves would be accorded space, and that it would be necessary to make application for each separate and distinct manufacturer represented, and also to procure written authority from each one to be so represented. To comply with such a ruling was out of the question, and the Simmons display will stay at home."

The New England Rock Drill Company have entirely transferred the manufacture of their rock drills from Auburn, Maine, to Boston. But few of the drills have ever been made in Auburn, while for some time past they have been quite extensively manufactured in Boston.—*Boston Journal of Commerce.*

Nearly $10,000,000 are invested in manufacturing at Erie, Pa., employing upwards of 5,000 men, and turning out some $13,000,000 in value of products yearly. In three years the capital has increased one third. The investment in iron manufactures has doubled, notwithstanding the manufacture of railroad iron has fallen off 56,000 tons since 1872, and 10,000 tons since 1879.

Machinists' Supplies.

NEW YORK, November 13, 1884.

The condition of the supply trade has changed very little since we commented upon it last. Hopes were entertained that when the elections were over men would begin devoting more of their time and attention to business, and that as a result improvement in trade would ensue. The distracting talk about the result of the elections has, however, prevented any improvement in business, and people are now waiting for returning calmness to produce the confidence that encourages trade.

Iron—Pig continues depressed, without any prospect of improvement. Several cheap Southern brands of pig iron are finding considerable favor with buyers, and are tending to depress prices, as they take the place of pig from Northern furnaces that cost more than that from the South. Standard Lehigh Valley and North River brands have ruled dull and nominal. No. 1 X. Foundry, at $19 50 to $20.50; but good, acceptable brands can be bought at tide-water for $19. No. 2 X. Foundry, $18 to $19.50. Grey Forge, $15 50 to $16.50.

Scotch pig has been quiet, with limited demand. The sales have been small, mostly retail lots. We quote Shotts, $21.50 to $21.75, to arrive; Coltness, $22, to arrive; Glengarnock, $20 50; Gartsherrie, $21.50 to $22; Summerlee, $21; Langloan, $21.

Copper—The demand for ingot has ruled light, without notable change in values. Lake generally held at 13c.; other brands 11⅝ to 12¼c.

Lead—The market for common pig is depressed, with a downward tendency. The nominal price is 3.50c., but buyers demand concessions.

Tin—This market has been dull and slightly fluctuating in sympathy with foreign prices. We quote for jobbing lots, Banca, 19¾ to 19⅞c.; Straits and Malacca, 16⅞ to 17⅛c.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

An M. E. desires to correspond with parties desiring a designer with experience and energy. Address D., care AM. MACHINIST.

Wanted—A foreman to take charge of a boiler shop. One who thoroughly understands all classes of boiler work; none other need apply. Address, giving references, "Foreman," care AM. MACHINIST.

Who will give me employment as journeyman, assistant, or foreman? Understand business thro'out. Can please you. Machinist, Drawer C, Laconia, N. H.

Wanted—Person having extensive experience as manager, designer, and salesman of tools and machinery, also well up in office routine and bookkeeping, speaking and corresponding in English, German, and French is open to an engagement. Intimate knowledge of European markets. Wood and sheet-metal machinery a specialty. Salary moderate, to begin with. Address W., 14, AM. MACH.

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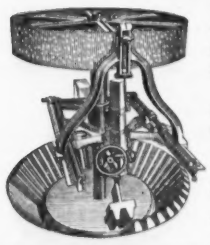

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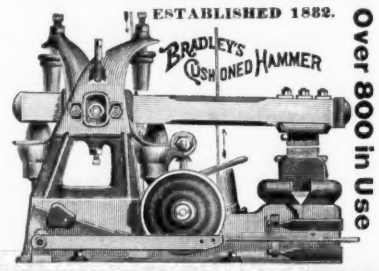

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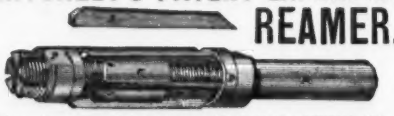

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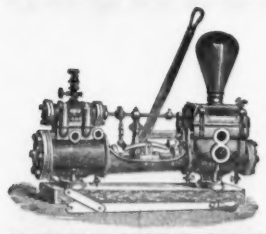

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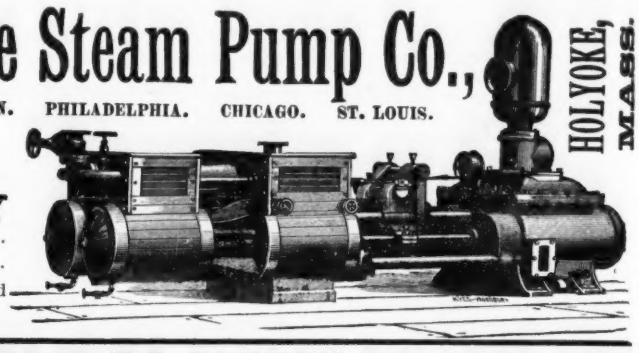

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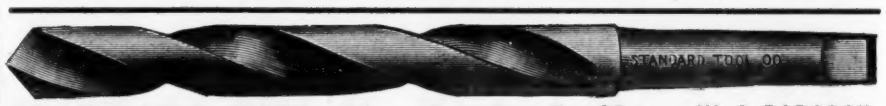

STANDARD TOOL CO., Cleveland, Ohio. W. A. BABCOCK. Manager.

IMPORTANT TO INVENTORS

An International Inventions' Exhibition, under the patronage of Her Majesty the Queen and the presidency of His Royal Highness the Prince of Wales, will be held in London in 1885.
The Exhibition will be opened in May 1885, and will continue open for a period of about 6 months.
DIVISION I. (Inventions) will be devoted to illustrations of Apparatus, Appliances, Processes and Products, invented or brought into use since 1862.
DIVISION II. (Music) will consist of examples of Musical Instruments of a date not earlier than the commencement of the present century; and of Historic Collections of Musical Instruments and Appliances, and Paintings, Engravings and Drawings representing musical subjects, without any restriction as to date.
Medals in Gold, Silver and Bronze, and Diplomas of Honor will be awarded on the recommendation of Juries. No charge will be made for space. It is expected that
AMERICAN INVENTIONS
will take a prominent place in this
Universal Exhibition,
and, for the convenience of contributors from the United States, the latest date for the reception of
APPLICATIONS FOR SPACE
has been extended from the 1st October to the 31st December 1884.
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HORIZONTAL ENGINES,
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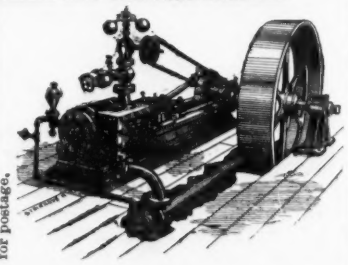

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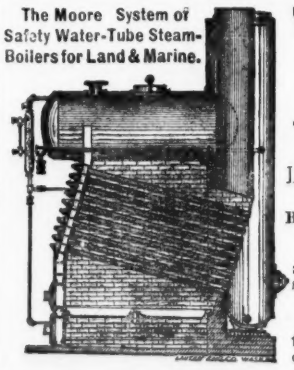

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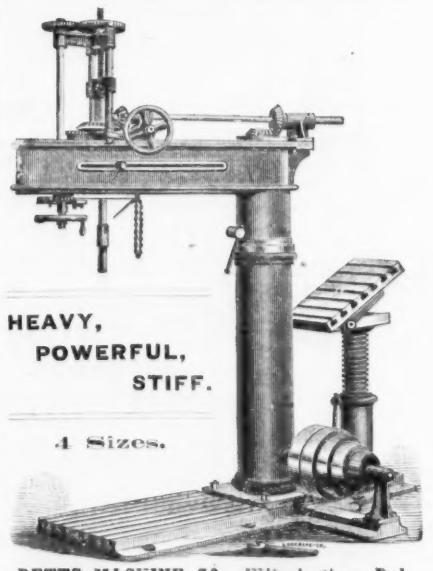

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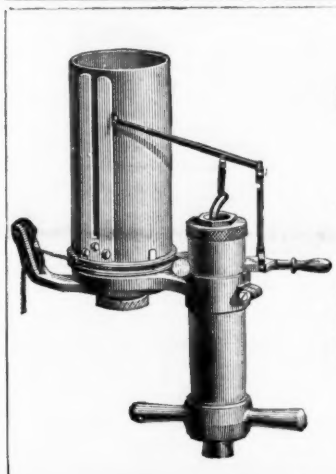

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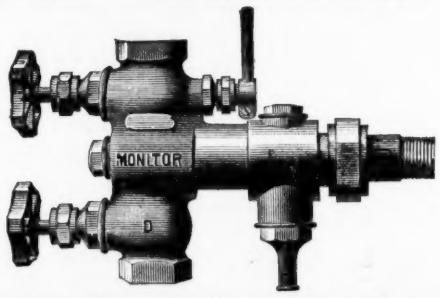

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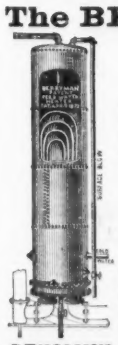

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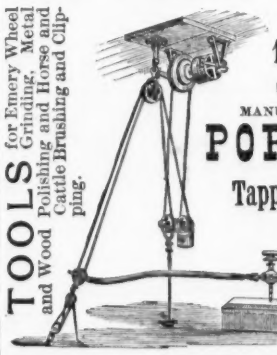

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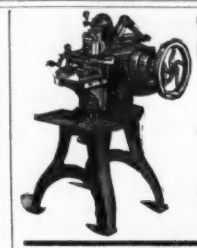

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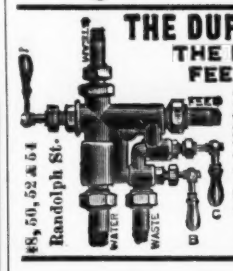

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" " " (2d order) Charleston, S. C.	60
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Thomson-Houston Elec. Lt. Co, Quincy, Ill.	60
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Thompson-Houston Electric Light Co., Phil., Pa.	50
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J. M. Gusky, Electric Light, Pittsburgh, Pa.	45
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Chas. Aubert, Irrigation, Port Allen, La.	40
Susquehanna Water Power & Paper Co, Conowingo, Md	35
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Morris Butt & Co., Kansas City Mo.	35
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Smith & James, Saw & Flower Mill, Col., Mo.	35
E. B. Ward, Ginning, Plainview, N. C.	30
W. W. Pugh, Draining, Home Place, La.	30
J. Lepayre, Irrigation, Bayou Goula, La.	30
Baltimore & Ohio R. R Shops, Columbus, O.	25
G. W. Young, Ginning, Honey Grove, Texas.	25
Harvey Miller, Nickel Plater, Cincinnati, Ohio.	25
Timothy Vinton, Paper Mill, Brattleboro, Vt.	25
Lawrence Machine Shop, (2d order) Lawrence, Mass	25
Lombard, Ayres & Co., Saw Mill, (3d order) Mobile, Ala.	20
H. W. Jones, Ginning, Row Landing, La.	20
Kingsland, Jackson & Co., Machinists, Chicago, Ill	15
J. Christman, Elevator, Stewartsville, Mo.	15
Bell Bros., Flour Mill, Osage, Iowa.	15
Fred. Hanson, Eau Claire, Wis.	15
G. B. Shaw, Elevator, Kansas City, Mo.	15
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Stoutz & Co., Planing Mill, Mobile, Ala.	15
T. G. Cansler, Ginning, Itaska, Texas.	15
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Shutte & Co., Planing Mill, Pittsburgh, Pa.	15
A. M. Good & Bro., Saw Mill, Waynesboro, Pa.	15
Hermann Fletcher, Louisville, Ky	12
Worcester Gas Light Co., Worcester, Mass.	8
Anderson & Barr, Philadelphia, Pa.	8
Thompson-Houston Elec. Lt. Co. (3d order) St. Louis Mo.	8
W. C. Kerr & Co., Yacht Engine, New York.	8
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H. L. Howe, Fan Blower, Canandaigua, N. Y.	8
Ed. Lehda, Tea Store, New Orleans, La.	4
R. H. Nevins, Ice Factory, Mayo, Fla.	4
F. Plumb, Ditching, (11th order) Streator, Ill.	4
" " (12th order) " "	4
Steamer "Big Sandy," Elec. Lt. Cincinnati, O.	4

Total, Fifty-eight Engines.....1,685 H.P.

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" 6	1 "	.80
" 7	1 1-8 "	.95
" 8	1 1-4 "	.95
" 9	1 3-8 "	1.10
" 10	1 1-2 "	1.10
" 11	1 5-8 "	1.25
" 12	2 "	1.40
" 13	2 1-4 "	1.60
" 14	2 1-2 "	1.60
" 15	3 "	1.80
" 16	3 1-2 "	2.00
" 17	4 "	2.30
" 18	4 1-2 "	3.00
" 19	5 "	3.50
Full set, 19 dogs,		23.35
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With Steel Screws. Lathe Made and Hardened.

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" 4	3-4 "	.70
" 6	1 "	.80
" 8	1 1-4 "	.95
" 10	1 1-2 "	1.10
" 11	1 3-4 "	1.25
" 12	2 "	1.40

Small set of 8 dogs from 3-8 to 2 ins. $7.30

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Set of 12 from 3-8 to 4 inches.....15.00

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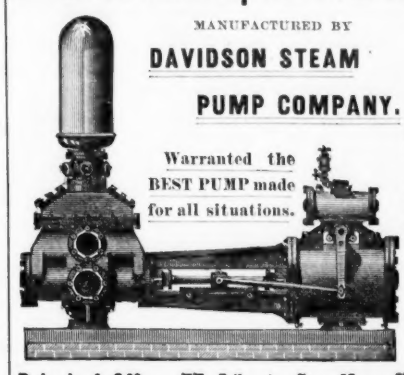

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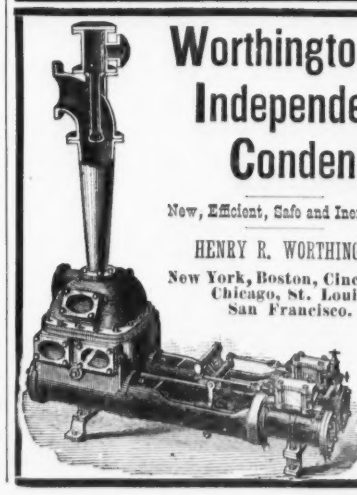

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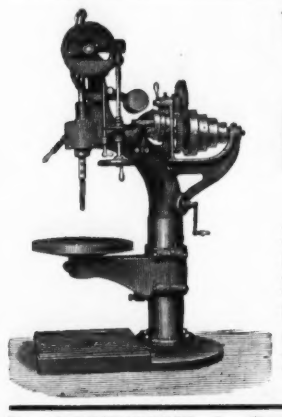

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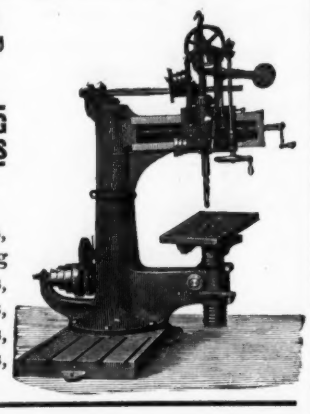

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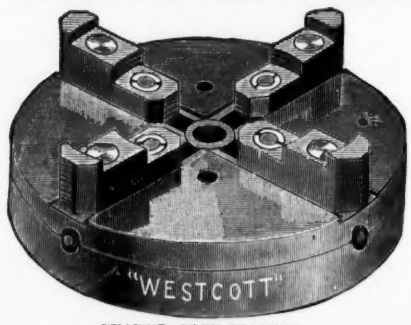

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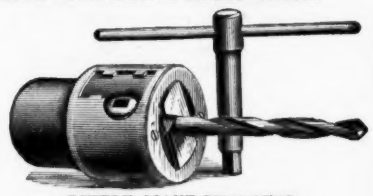
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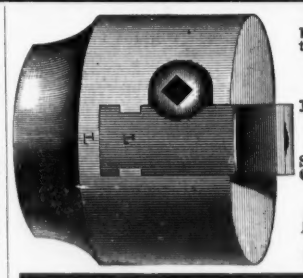

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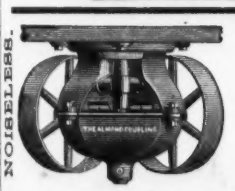

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The Almond Coupling.
A new quarter turn motion to replace quarter turn belts and bevel gears.
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NEW HAVEN MANUF'G CO.,
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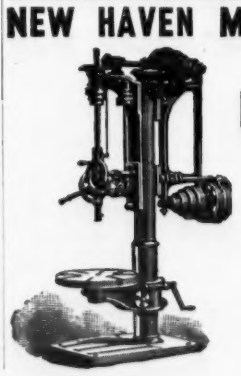

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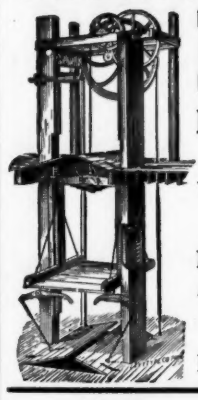

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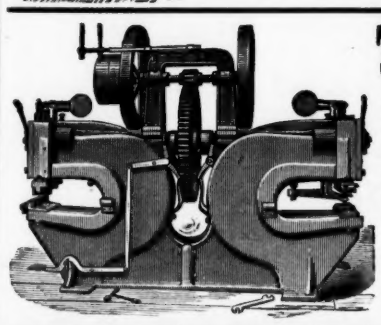

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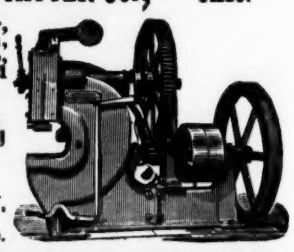

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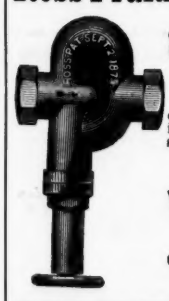

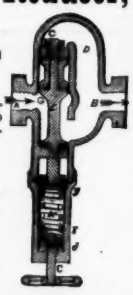

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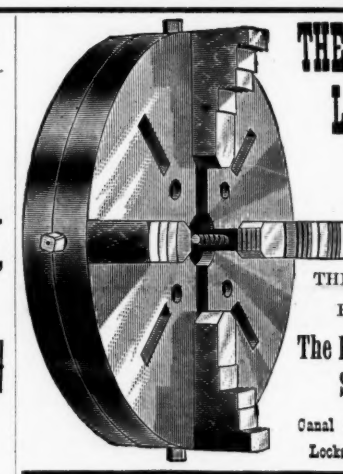

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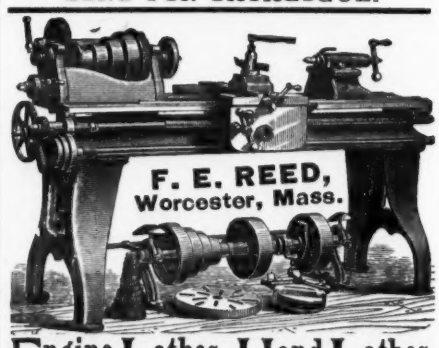

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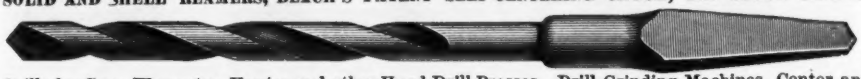

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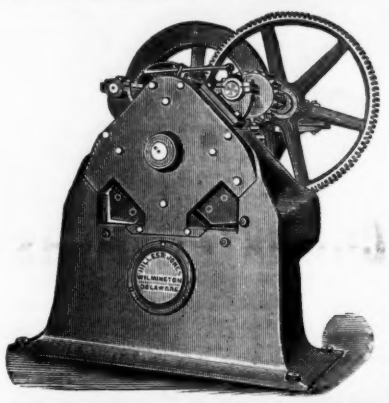

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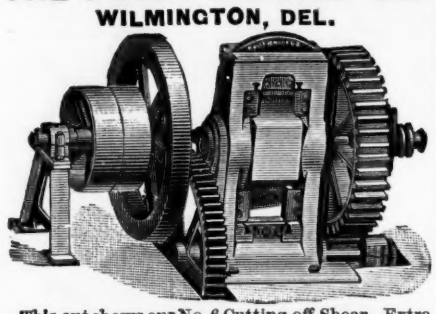

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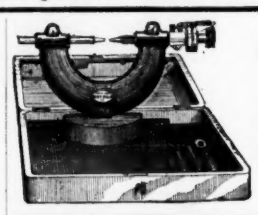

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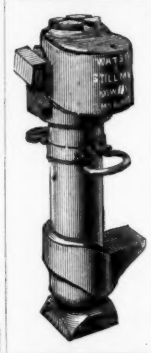

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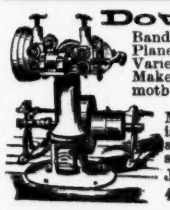

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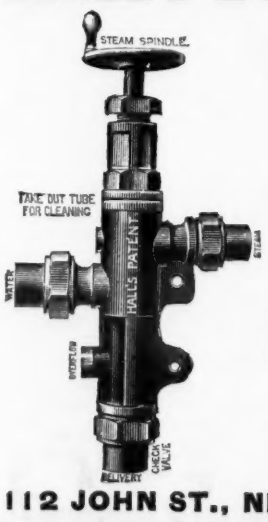

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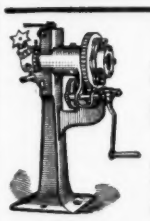

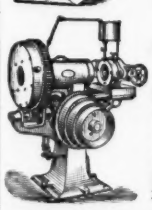

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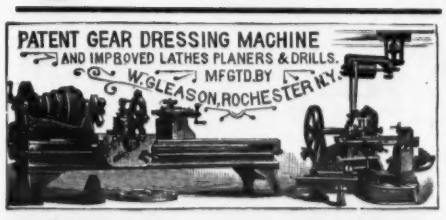

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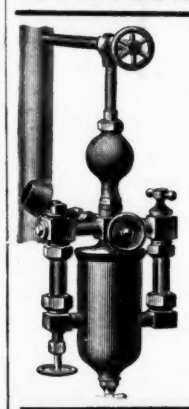

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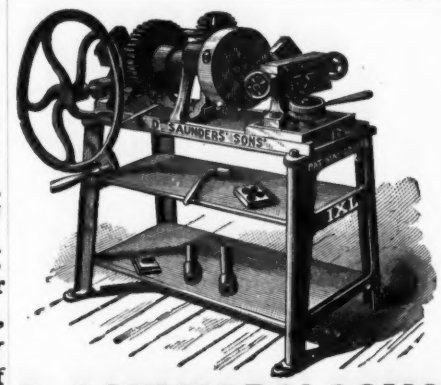

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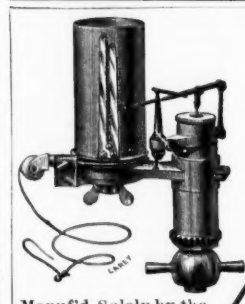

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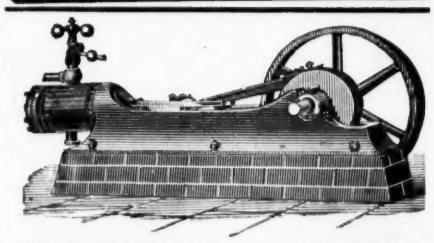

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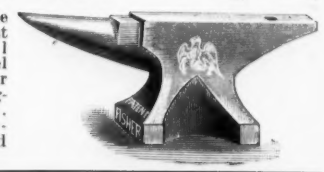

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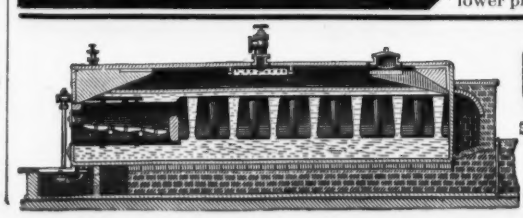

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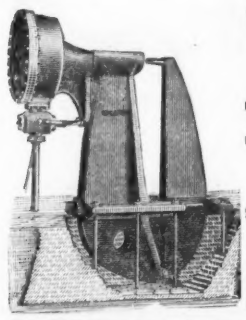

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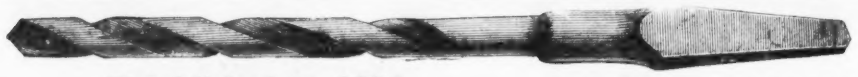

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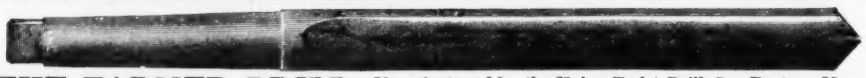

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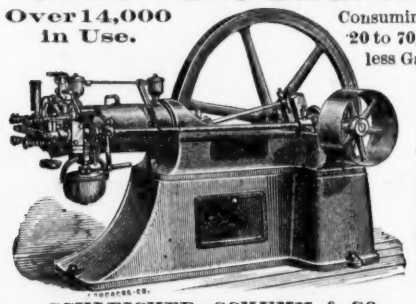

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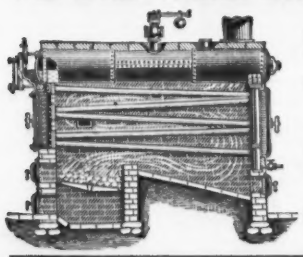

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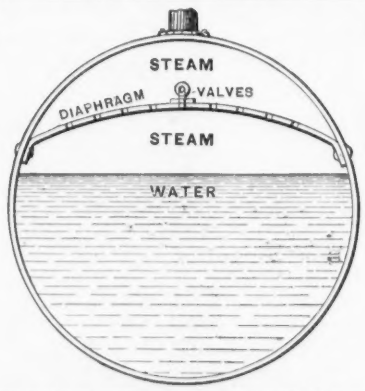

This is the only steam boiler ever devised in strict compliance with the demands of natural laws. It gives complete immunity against explosions, delivers dry steam, prevents all incrustation and deposit on the bottom plates, affords safety with high pressure, and secures great economy. The invention is applicable to every style of boiler, and can be readily applied, internally or externally, to new or old boilers. Licenses granted on liberal terms to manufacturers. Send for description.

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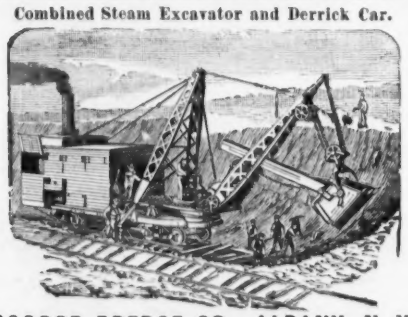
Combined Steam Excavator and Derrick Car.



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guaranteed to excavate 50 per cent. more material from hard bottom than any other machine.

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has a capacity of 6 cubic yards per minute.

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Derrick lifts 8 tons.

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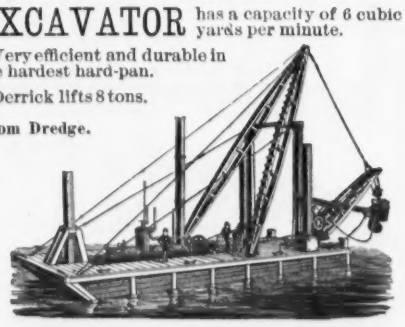

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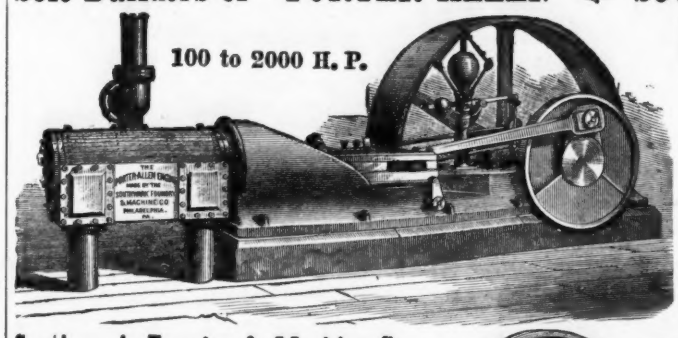

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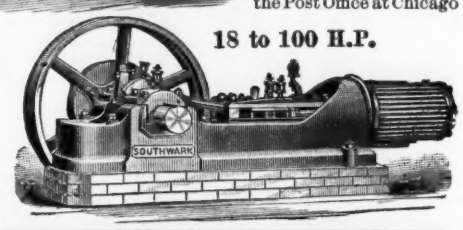

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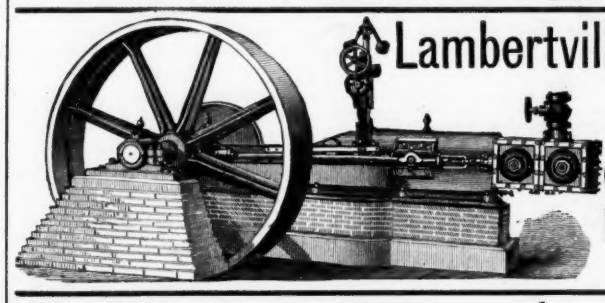

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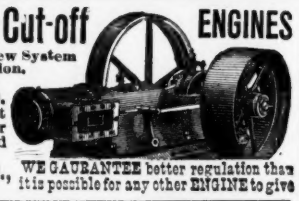

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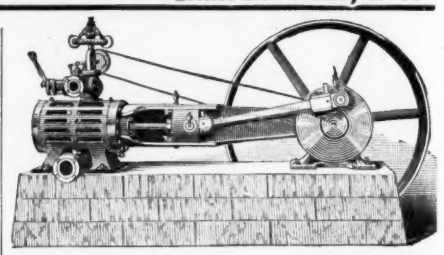

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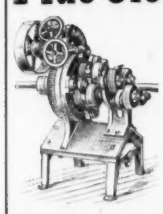

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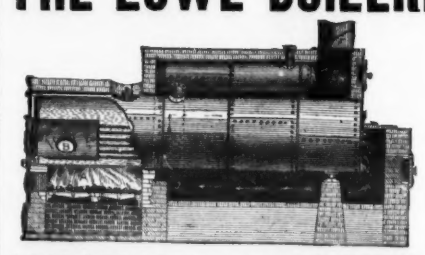

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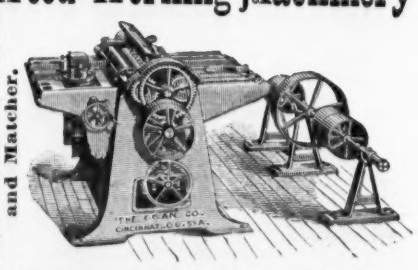

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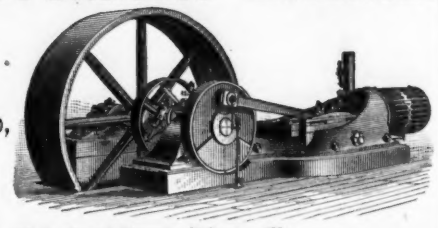

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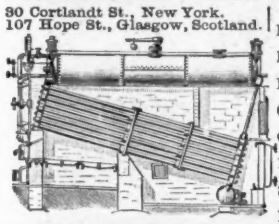

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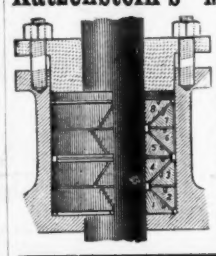

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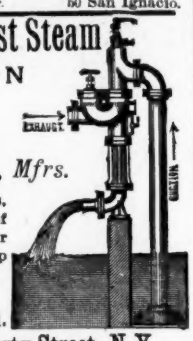

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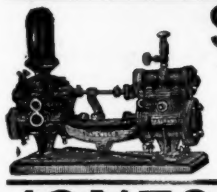

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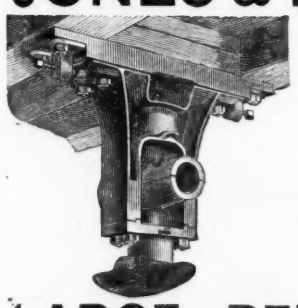

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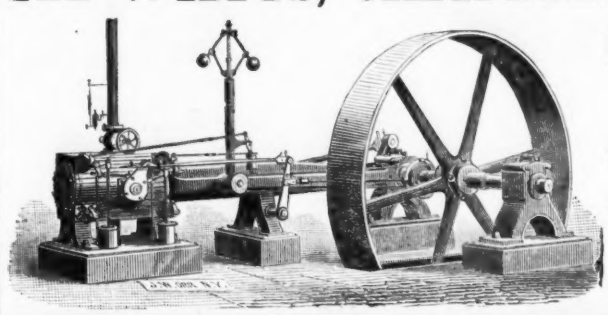

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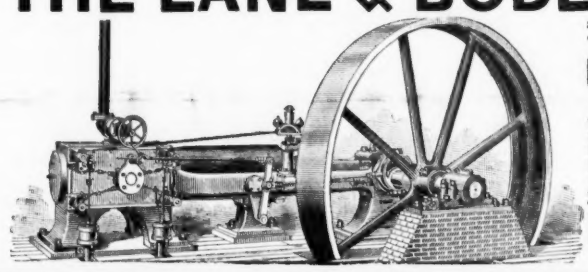

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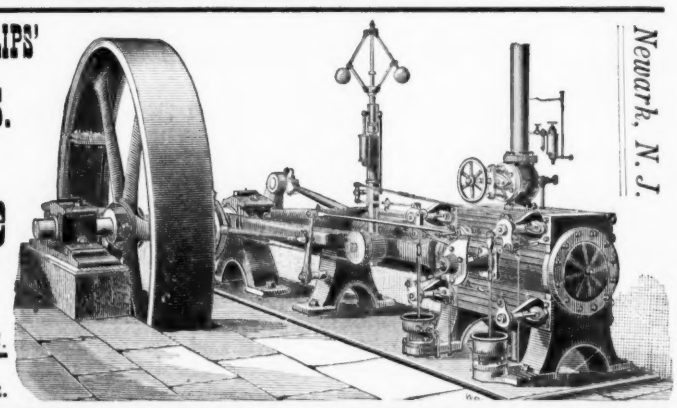

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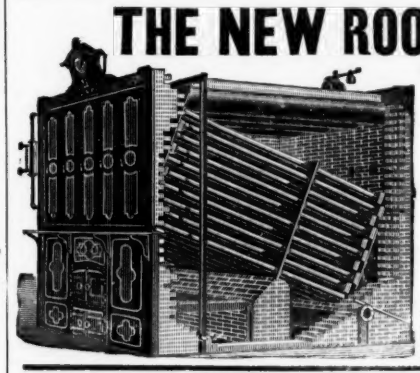

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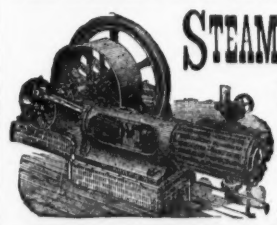

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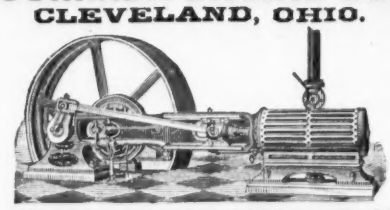

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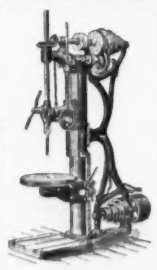

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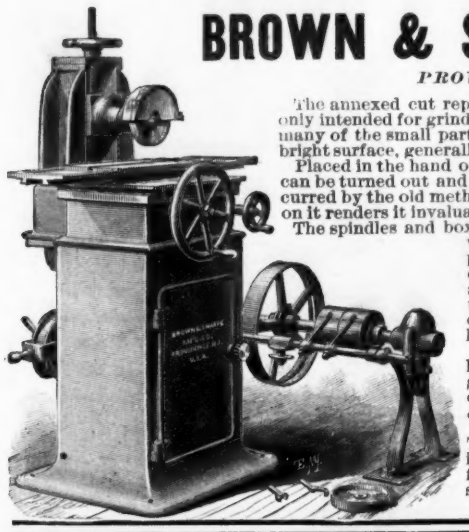

The annexed cut represents a Small Surface Grinding Machine, not only intended for grinding and finishing hardened dies, punches, &c., but many of the small parts of machinery and tools, requiring a true and bright surface, generally produced with files, &c.

Placed in the hand of an intelligent workman, more and better work can be turned out and at a cost not exceeding one-quarter of that incurred by the old method; while the amount of work that can be done on it renders it invaluable for machine and tool work.

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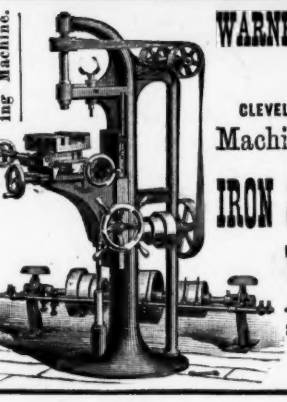

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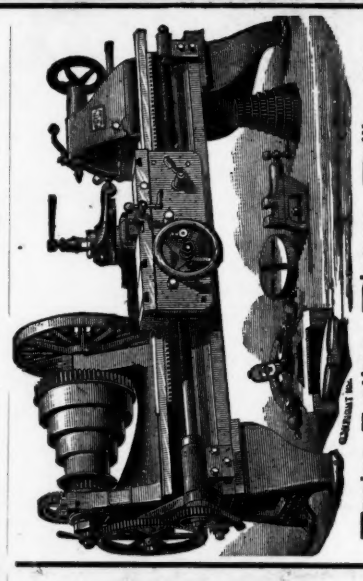

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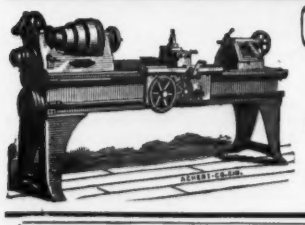

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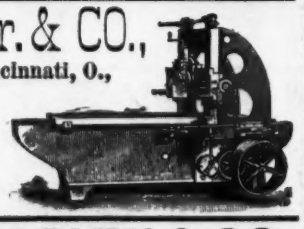

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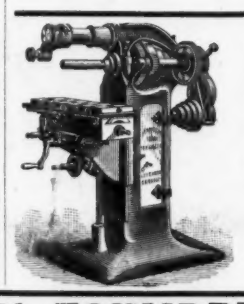

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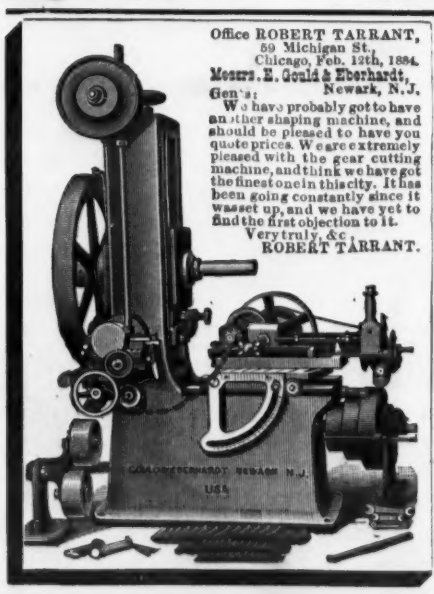

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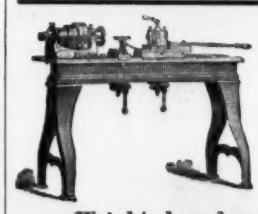

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